With METALLURGICAL SUPPLEMENT.

DEC 16 1929

# The Engineer.

Established 1856. Registered as a Newspaper.

OFFICE FOR ADVERTISEMENTS & PUBLICATION, 33, NORFOLK ST., STRAND, LONDON, W.C. 2.

VOL. CXLVIII.—No. 3855] LONDON: FRIDAY EVENING, NOVEMBER 29, 1929 [PRICE { WITH SUPPLEMENT } ONE SHILLING BY INLAND POST 1s. 3d.

## PUBLIC NOTICES

WIRING.

**The Commissioners of** His Majesty's Works, &c., are prepared to receive TENDERS before 11 a.m. on Tuesday, 17th December, 1929, for RE-WIRING for ELECTRIC LIGHTING at (1) the Patent Office, (2) the Public Record Office, W.C.

Specification, a copy of the conditions and form of contract, bills of quantities, and forms for Tender may be obtained from the CONTRACTS BRANCH, H.M. Office of Works, King Charles-street, London, S.W. 1, on payment of One Guinea in each case. (Cheques payable to the Commissioners, H.M. Office of Works.) The sums so paid will be returned to those persons who send in Tenders in conformity with the conditions. 3856

**The Director-General,** India Store Department, Belvedere-road, Lambeth, London, S.E. 1, invites TENDERS for :—

SCHEDULE 1.—18 SPANS of 156ft. 6in. (about 3365 Tons).

SCHEDULE 2.—2 SERVICE SPANS of 160ft. (about 411 Tons).

Tenders due 17th January, 1930.

Forms of Tender available from the above at a fee (which will not be returned) of 5s. for each Schedule. 3854

**Civil Service Commission.**

FORTHCOMING EXAMINATION. — ASSISTANT EXAMINERS in the Patent Office (20-25, with extension in certain cases).

Regulations and particulars, together with the forms on which applications must be made, will be sent in response to requests (preferably by postcard), addressed to the SECRETARY, Civil Service Commission, Burlington-gardens, London, W. 1. The latest date for the receipt of application forms is 6th March, 1930. 3846

**Crown Agents for the** COLONIES.

COLONIAL GOVERNMENT APPOINTMENTS.

APPLICATIONS from qualified candidates are INVITED for the following POSTS :—

M/1740.—ASSISTANT HARBOUR ENGINEER REQUIRED by the GOVERNMENT of the GOLD COAST for the Takoradi Harbour, for a tour of 12 to 18 months' service. Salary £480 a year for the first three years of service and then £510, rising to £720 by annual increments of £30 and thence to £920 a year by annual increments of £40. Outfit allowance of £60 on first appointment. Free quarters and passages and liberal leave on full salary. Candidates, age 25 to 35, must have passed "A" and "B" of the examinations to qualify for the A.M.I.C.E. Diploma or hold professional qualifications recognised by the Institution of Civil Engineers as exempting from those examinations. Should have had some civil engineering experience outside pupilage, preferably on harbour and dock works.

M/1807.—CIVIL ENGINEER REQUIRED by the GOVERNMENT of CEYLON for appointment as Irrigation Engineer for three years' service and prospect of permanency. Salary £560, rising to £900 a year by annual increments of £40 (£600 a year on attaining 30 years of age). Free quarters and free passages provided. Candidates, unmarried, 26 to 31 years of age, must have passed examination to qualify for Associate Membership of the Institution of Civil Engineers or hold professional qualifications recognised by the Institution as exempting from Parts "A" and "B" of that examination, and have had at least three years' practical experience on waterworks, drainage or harbour and dock works.

Apply at once by letter, stating age, whether married or single, and full particulars of qualifications and experience, to the CROWN AGENTS FOR THE COLONIES, 4, Millbank, London, S.W. 1, quoting the reference number against the appointment for which application is made. 3857

**Borough Polytechnic Institute,** BOROUGH-ROAD, LONDON, S.E. 1.

HEAD OF DEPARTMENT OF MECHANICAL AND STRUCTURAL ENGINEERING AND BUILDING.

The Governors invite APPLICATIONS for the above-named APPOINTMENT, rendered vacant by the promotion of the present holder to a Principalship. Subject to the agreement of the London County Council, the post will be graded as a Class I. Head of Department, with a salary scale £675-£25-£830. Full-time service is required. Particulars of the appointment and form of application may be obtained by sending stamped addressed foolscap envelope to the undersigned.

J. W. BISPHAM, Principal.

3830

**Borough Polytechnic Institute,** BOROUGH-ROAD, LONDON, S.E. 1.

The Governors invite APPLICATIONS for the POST of Visiting Evening LECTURER in REFRIGERATION, on Wednesdays.

Candidates should possess good knowledge of the science of refrigeration as well as practical experience.

Applications, stating age, qualifications, training and experience, should be forwarded to the undersigned.

J. W. BISPHAM, Principal.

3858

**West Bromwich Education** COMMITTEE.

KENRICK TECHNICAL COLLEGE.

Principal : R. C. PRESCOTT, M.Sc., M.I. Mech. E.

DAY TECHNICAL SCHOOL.

APPLICATIONS are INVITED for the POST of LECTURER in ENGINEERING at the above College. Candidates should possess an Honours Degree in Mechanical Engineering, with some knowledge of Electrical Engineering. Salary will be according to the Burnham Scale.

Particulars and application form for the post may be obtained from the undersigned on receipt of a stamped addressed foolscap envelope. Applications should be received not later than 14th December.

ARTHUR LEWIS, Director of Education.

Education Offices, West Bromwich, 27th November, 1929. 3861

## The Engineer

PRINCIPAL CONTENTS OF THIS ISSUE.
ARRANGED FOR CARD INDEXING.

The Metallurgist.
THE ENGINEER, 29 - 11 - 29.

An Engineering and Shipbuilding Works at Cowes. (P. 570)
THE ENGINEER, 29 - 11 - 29.

The Modernisation of Japan. (P. 572)
THE ENGINEER, 29 - 11 - 29.

Salesmanship. (P. 583)
THE ENGINEER, 29 - 11 - 29.

Public Works, Roads & Transport Exhibition No. II. (P. 586)
THE ENGINEER, 29 - 11 - 29.

Battersea Power Station and Sulphur. (P. 576)
THE ENGINEER, 29 - 11 - 29.

A Visit to an Electrical Machinery Factory. (P. 573)
THE ENGINEER, 29 - 11 - 29.

A New Transmission Gear for Motor Vehicles. (P. 578)
THE ENGINEER, 29 - 11 - 29.

A High-speed Grinding Machine. (P. 590)
THE ENGINEER, 29 - 11 - 29.

## INDEX TO ADVERTISEMENTS, PAGE 81.

## PUBLIC NOTICES

**University of the Witwatersrand,** JOHANNESBURG.

DEPARTMENT OF PHYSICS.

LECTURE ASSISTANT.

REQUIRED for February, 1930, or as soon thereafter as possible, LECTURE ASSISTANT, who must be experienced in the handling of general physical apparatus; preference will be given to applicants who have experience in Glass Blowing or Workshop Practice.

Salary £248-£26 10s. £354 per annum, subject to Provident Fund contributions. Half salary will be paid from date of embarkation to date of arrival in Johannesburg.

Transport, third-class steamer fare and second-class railway fare, will be allowed, subject to proportionate refund in the event of resignation within two years.

Applications, together with copies of testimonials, all in triplicate, should reach the SECRETARY, the Office of the High Commissioner for the Union of South Africa, South Africa House, Trafalgar-square, W.C. 2 (from whom form of applications and further particulars may be obtained)), not later than 6th December, 1929. 3766

**County Borough of Southampton.**

CAST IRON PIPES AND SPECIAL CASTINGS.

The Corporation invite TENDERS for the SUPPLY and DELIVERY of about 10,200 LINEAL YARDS of 15in. C.I. SOCKET and SPIGOT PIPES and about 30 TONS of SPECIAL CASTINGS.

Specification, schedule and form of Tender may be obtained at the Waterworks Offices, 21, Shirley-road, Southampton.

Sealed Tenders, endorsed "Tender for 15in. Pipes and Specials," must be delivered at the Town Clerk's Office, Southampton, on or before Ten o'clock in the forenoon of the 12th December, 1929.

Tenders from British manufacturers only will be considered.

No pledge is given to accept the lowest or any Tender.

R. RONALD H. MEGGESON, Town Clerk.

15th November, 1929. 3764

## PUBLIC NOTICES

**County Borough of Southampton.**

TO CONTRACTORS AND OTHERS.

The Corporation invite TENDERS for the LAYING and JOINTING of about 10,200 YARDS of 15in. C.I. SOCKET and SPIGOT WATER MAIN from Yew Hill Reservoir, Compton, to the junction of Stoneham-road with the Southampton-Winchester Road, North Stoneham.

Plans may be seen and specification, bill of quantities and form of Tender obtained at the Waterworks Offices, 21, Shirley-road, Southampton, upon production of the Borough Treasurer's receipt for a deposit of £3 3s. Deposits will be returned after the Council have dealt with the Tenders to contractors who have submitted bona fide Tenders.

Sealed Tenders, endorsed "15in. Water Main, Yew Hill to North Stoneham," on the prescribed form, together with priced quantities and schedule, must be delivered at the Town Clerk's Office, Southampton, on or before the 12th December, 1929.

No pledge is given to accept the lowest or any Tender.

R. RONALD H. MEGGESON, Town Clerk.

15th November, 1929. 3765

**South Indian Railway Company, LIMITED.**

The Directors are prepared to receive TENDERS for the SUPPLY of :—

1. METALS.
2. MILD STEEL BARS, SECTIONS, &c.
3. COPPER RODS and TUBES, and
4. BEST YORKSHIRE IRON.

Specifications and forms of Tender will be available at the Company's Offices, 91, Petty France, Westminster, S.W. 1.

Tenders, addressed to the Chairman and Directors of the South Indian Railway Company, Limited, marked "Tender for Metals," or as the case may be, with the name of the firm tendering, must be left with the undersigned not later than Twelve Noon on Friday, the 13th December, 1929.

The Directors do not bind themselves to accept the lowest or any Tender.

A charge, which will not be returned, will be made of 10s. for each copy of Specifications Nos. 1, 2 and 3, and of 5s. for each copy of Specification No. 4.

A. MUIRHEAD, Managing Director.

91, Petty France, Westminster, S.W. 1, 27th November, 1929. 3864

## PUBLIC NOTICES

**County Borough of Southend-on-Sea.**

The Corporation of Southend-on-Sea invite OFFERS for approximately 64 TONS of OLD 64in. TRAM-RAILS and approximately 1 TON of OLD TIE BARS, to be removed from the tram track.

Dealers desirous of submitting an Offer should make an inspection of the material at the Southchurch-road Depot and obtain particulars from Mr. Robert H. Dyer, Borough Engineer, Clarence-road, Southend-on-Sea.

Offers, endorsed "Scrap Tramway Metal," should reach the office of the Borough Engineer not later than 9 a.m. on Monday, 9th December, 1929.

H. J. WORWOOD, Town Clerk.

Municipal Buildings, Southend-on-Sea, November, 1929. 3842

**County of London.**

SUPPLY OF TRAMWAY RAILS, &c., 1930-31.

The London County Council invites TENDERS for the SUPPLY and DELIVERY in London of :—

(1) About 5300 TONS of TRACK RAILS and 25 TONS of FISH-PLATES.

(2) About 200 TONS of CONDUCTOR TEE RAILS.

(Tenders will be considered for separate sections).

The specifications, forms of Tender, drawings, &c., may be obtained on application to the General Manager of the Council's Tramways, 23, Belvedere-road, S.E. 1, upon payment of the sum of £2 in each case (i.e., (1) and (2) by cheque or draft to the order of the London County Council). This amount will be returnable only if the tenderer shall have sent in a bona fide Tender and shall not have withdrawn the same. Full particulars of the work may be obtained on personal application, and the contract documents may be inspected before payment of the fee. Correspondence and remittances by post should be addressed to the General Manager of the Council's Tramways, 23, Belvedere-road, S.E. 1, or, if personal application is made, applicants should apply in Room 222 at above address in respect of item (1) and in Room 202 in respect of item (2).

Contractors will be bound to observe the provisions of a fair wages clause, the terms of which are set out fully in the instructions for Tender and form of contract and in "The London County Council Gazette."

No Tender received by the Clerk of the Council at the County Hall, Westminster Bridge, S.E. 1, after 4 p.m. on Monday, 9th December, 1929, will be considered.

The Council does not bind itself to accept the lowest or any Tender.

MONTAGU H. COX, Clerk of the London County Council.

3828

**Edmonton Union.**

The Guardians invite TENDERS for the PURCHASE and REMOVAL of a GALLOWAY TYPE BOILER, 20ft. 3in. by 7ft., with Caddy's Fire-bars, Safety Valve to 75 lb., Hopkinson's Junction Valves, Dewrance's Water Gauges, Hopkinson's Feed Valve. The boiler may be inspected at Edmonton House, 77, Bridport-road, Edmonton.—Offers to be sent to CLERK to GUARDIANS, Board Room, 77, Bridport-road, Edmonton. 3850

**Parish of Willesden.**

REPAIRS TO BOILERS.

The Guardians of the above-named Parish are prepared to invite TENDERS for RE-TUBING TWO DRY-BACK TYPE BOILERS, No. 1 and No. 2, at Park Royal Hospital, Acton-lane, Willesden.

Firms wishing to Tender to the specification prepared by the Guardians' Consulting Mechanical Engineer, Mr. W. M. Binay, A.M.I.C.E., M. Cons. E., are requested to send their names to the Clerk to the Guardians, with reference to similar recent work carried out by them at other institutions.

Firms are requested in the first instance to visit the Hospital (between the hours of 9 a.m. and 5 p.m.) and see the boilers requiring repair, and a copy of the Consulting Engineer's specification, before sending their names to the Clerk.

Firms selected to Tender will be provided with a copy of the specification and form of Tender on paying a deposit of £1, which will be returned on receipt of a Tender properly filled in.

Applications to be allowed to Tender must be received by the Clerk to the Guardians not later than the first post on Tuesday, the 10th day of December, 1929.

By Order, J. HUTTON HAYLOR, Clerk to the Guardians.

Guardians' Offices, 409, High-road, Brondesbury, N.W. 6, November, 1929. 3866

PUBLIC NOTICES (continued) Page 2.
SITUATIONS OPEN, Page 2.
SITUATIONS WANTED, Page 2.
AUCTIONS, Pages 4 and 82.
MACHINERY, &c., WANTED, Page 3.
EDUCATIONAL, Page 3.
PATENTS, Page 3.
PARTNERSHIPS, Page 2.
MISCELLANEOUS, Page 3.
AGENCIES, Page 2.
FOR SALE, Pages 4 and 82.
WORK WANTED, Page 4.
FOR HIRE, Page 3.

*For Advertisement Rates see Leader Page.*

## PUBLIC NOTICES

**The Assam-Bengal Railway** COMPANY, Limited, is prepared to receive TENDERS for :—

BOGIE CARRIAGE UNDERFRAMES, BODY IRONWORK and FITTINGS for BOGIE TOURIST CAR, BOGIE COMPOSITE FIRST and SECOND-CLASS CARRIAGE and BOGIE RESTAURANT CAR.

Specifications and Tender forms may be obtained at the offices of the Company, Bishopsgate House, 80, Bishopsgate, E.C. 2. A fee of £1 1s. is charged for each specification, which cannot, under any circumstances, be returned.

Drawings may be had at the cost of the tenderer by application to Messrs. Hodges, Bennett and Co., Ltd., 78, Queen Victoria-street, E.C. 4.

Tenders must be delivered at the Company's offices not later than Noon on Wednesday, the 18th December, 1929.

By Order of the Board,
THOS. C. BRETT,
Secretary.
26th November, 1929. 3841

**Uxbridge Urban District** COUNCIL.
SALE OF MACHINERY.

The Council invite TENDERS for the PURCHASE of :—

30 H.P. COMPOUND VERTICAL SURFACE CONDENSING STEAM ENGINE, with Fly-wheel and Crank Shaft, Governor, Gauges, Oil and Grease Separators and Condenser, &c., by Goddard, Massey and Warner, as fixed at Waterworks, Uxbridge, Middlesex.

Worthington Type DOUBLE-THROW FEED PUMP, by Mumford, with 3in. Steel Feed Pipes, as fixed.

SET of 8½in. diameter THREE-THROW PUMPS, with Crank Shaft with Helical Drive, Gun-metal Barrels, Buckets and Rods, Brass Bearings, Flanged Iron Suction, Stand Pipes and Rising Main, &c., as removed from Well.

Particulars to be obtained from Council's Surveyor, Mr. Wm. L. Eves, 54, High-street, Uxbridge.

Tenders, endorsed "Tender, Engine and Pumps," to be sent to the undersigned not later than Twelve o'clock Noon on the 12th day of December, 1929.

H. M. BLACKWELL,
Clerk.
Council Offices, "Southfield," High-street, Uxbridge. 3786

**Cambridgeshire Mental Hospital**, FULBOURN, NEAR CAMBRIDGE.

The Committee of Visitors invite APPLICATIONS for the POST of RESIDENT ENGINEER. Applicants should have had experience, preferably Institution, in Electricity, both light and power, Boiler Plant, Central Heating Systems, and Deep Well Pumps. Salary £250 per annum, rising annually by £12 10s. to £300, plus unfurnished house valued for superannuation purposes at £26 per annum. The appointment will be made subject to the provisions of the Asylum Officers' Superannuation Act, 1909, and the successful candidate will be required to pass a medical examination.

Applications, in writing, stating experience, age, civil state, and enclosing copies of recent testimonials, to be addressed to the MEDICAL SUPERINTENDENT not later than the 7th December, 1929. Envelopes to be marked "Engineer."

Canvassing, directly or indirectly, will be a disqualification. 3840

**Wakefield Corporation Waterworks.**

WANTED for a minimum period of eighteen months, QUALIFIED ASSISTANT ENGINEER, with at least three years' experience, including Trunk Mains Surveying and Levelling. Salary £300 to £350 per annum, according to experience.

Applications, stating age, qualifications and experience, accompanied by two recent testimonials, to be made to C. Clemesha Smith, M. Inst. C.E., Waterworks Engineer, Town Hall, Wakefield, on or before Monday, 9th December.

A. C. ALLIBONE,
3821 Town Clerk.

## SITUATIONS OPEN

COPIES OF TESTIMONIALS, NOT ORIGINALS, UNLESS SPECIFICALLY REQUESTED.

WANTED, ASSISTANT SUPERINTENDENT for large works engaged on light mass production. Successful executive experience as well as good practical knowledge of tools and methods necessary.—Address reply, 3725, The Engineer Office. 3725 A

WANTED, AUTOMOBILE ENGINEER, Qualified to design Internal Combustion Engines. Salary £400-£500 plus commission.—Address, stating age, practical experience, where trained in theory, P6436, The Engineer Office. P6436 A

A FIRM of ENGINEERS Making Lifting and Conveying Machinery have an OPENING for a MAN to Take Charge of a Section. The vacancy calls for engineering knowledge and preferably a special knowledge of Conveying Machinery, but commercial capacity as represented by personality, reliability and a capacity for work is more important. No person need apply who is not able to earn a salary of £500 to £600 per annum. Applicants should not be under 25 or over 35 years of age. The post offers advancement and prospects. State age, give the fullest particulars of previous experience and salary.—Address, 3822, The Engineer Office. 3822 A

ASSISTANT REQUIRED for Plant Layout Department of Commercial Motor Factory.—Apply, stating experience, age, and salary required, to EMPLOYMENT DEPARTMENT, Morris Commercial Cars, Ltd., Soho, Birmingham. 3760 A

ENGINEER REQUIRED, with First-class Manufacturing experience, preferably specialist in Labour-saving and Mechanical Handling Appliances. American or German experience an advantage. State full particulars of experience, age, and salary required. —Address, 3773, The Engineer Office. 3773 A

EXPERIENCED DESIGNER REQUIRED for Development Work in Heating and Ventilating. Electrical knowledge essential. Good wages.—Address, giving age and experience and wages required, 3849, The Engineer Office. 3849 A

HEAD COSTING CLERK, Wide Experience Costing of Small Parts in large quantities. Only first-class man with modern ideas need apply, stating salary and full particulars of past experience.—Address, 3833, The Engineer Office. 3833 A

INDUSTRIAL ENGINEER.—Age 28-35. Sound technical education, a University Engineering Degree preferred.

Four to five years' practical shop experience essential. Position offers attractive financial future. Post in Great Britain.

Candidates, in replying, should state age, present salary, and general qualifications.

Address, P6457, The Engineer Office. P6457 A

MANAGER for Engineering and Woodworking Factory, capable of large increased production of Fire Escapes and Appliances, Ladders, Trucks, &c. Must give proof of past career and ability; hours 7 a.m. to 6 p.m. and to 1 Saturdays. No novice need apply, as a real experience is necessary to be proved.—Mr. HEATHMAN, 4, Fulham Park-gardens, London, S.W. 6. 3829 A

REFRIGERATING ENGINEER REQUIRED as REPRESENTATIVE for Lancashire. Fully capable of dealing with inquiries for both large and small Refrigerating Plant for well-established firm. Local knowledge preferred. Salary and commission.—Address, 3835, The Engineer Office. 3835 A


# ARNOLD BOOKS

*New Fourth Edition.* *Ready Dec. 5th.*

## THE BALANCING OF ENGINES.

By W. E. DALBY, M.A., M. Inst. C.E., F.R.S., University Professor of Engineering, Imperial College of Science. viii + 320 pages, 218 diagrams. **21s.** net.

The method of solving balancing problems as developed in this book has received world-wide acceptance, and the work has assumed new importance in the light of the Report of the Bridge Stress Committee. The Author was a member of this Committee, and has reviewed its experiments, conclusions, and recommendations for the impact allowances to be made in new bridges. The whole book has been completely revised and the section dealing with the balancing of internal combustion engines greatly enlarged.

**STRENGTH AND STRUCTURE OF STEEL AND OTHER METALS.** By W. E. DALBY, F.R.S. xii + 172 pages, 169 diagrams, including 38 plates from original microphotographs. **18s.** net.

**THE STRENGTH OF MATERIALS.** **A Treatise on the Theory of Stress Calculations for Engineers.** By JOHN CASE, M.A., F.R.Ae.S., Lecturer in Applied Mechanics at the Royal Naval Engineering College, Keyham. viii + 552 pages, with 398 diagrams. **30s.** net.

**THE PRACTICE OF RAILWAY SURVEYING AND PERMANENT WAY WORK.** By S. W. PERROTT, M.A.I., M. Inst. C.E., Professor of Civil Engineering in the University of Liverpool, and F. E. G. BADGER, A.M. Inst. C.E. viii + 304 pages, 125 diagrams and 15 folding plates. **30s.** net.

**MODERN METHODS OF WATER PURIFICATION.** By JOHN DON, F.I.C., A.M.I. Mech. E., and JOHN CHISHOLM, A.M.I. Mech. E., Engineer and Manager of the Airdrie, Coatbridge and District Waterworks. SECOND EDITION. xviii + 398 pages, 106 illustrations. **16s.** net.

LONDON EDWARD ARNOLD & CO. 41 & 43, MADDOX ST. W.

CROSBY LOCKWOOD & SON

JUST READY. 240 Pages. Profusely Illustrated by diagrams. Half-tone Plates and Folding Plans. Cloth. 25s. net

**RAILWAY AND SEAPORT FREIGHT MOVEMENT**

With Examples of British and American Practice.

By GEORGE BULKELEY, A.M.I. Mech. E.

Port Manager, Kenya and Uganda Railways and Harbours. (Formerly on Personal Staff of General Manager, Great Western Railway, England; and Docks Traffic Superintendent Swansea.)

With an Introduction By
His Excellency Sir EDWARD GRIGG, K.C.M.G., D.S.O., M.C.

STATIONERS' HALL COURT, LONDON, E.C.

## PITMAN'S TECHNICAL BOOKS

*Just Published.*

**HIGH VOLTAGE CABLES.** By P. DUNSHEATH, O.B.E., M.A.

*Research and Technical Manager, W. T. Henley's Telegraph Works Co.* This book deals fully with the theory and practice of the design of cables for carrying power, as distinguished from telephone cables. It will be of considerable interest and value to consultants, engineers engaged on research work in cable factories and technical lecturers. Demy 8vo, 250 pp., illustrated. **10s. 6d. net.**

*New Edition Ready.*

**THE THEORY & PRACTICE OF ALTERNATING CURRENTS.**

By A. T. DOVER, M.I.E.E., A.Amer. I.E.E. This book contains an explanation of general principles, circuits, polyphase systems, non-sinusoidal wave-forms, the magnetization of iron, instruments, measurements, and an elementary treatment of the initial conditions in the simplest electric circuits. Demy 8vo, cloth gilt, with 303 illustrations. Second revised edition. **18s. net.**

**HANDBOOK ON BALL & ROLLER BEARINGS.**

By A. W. MACAULAY, A.M.I. Mech. E. A practical reference book on the design, application and maintenance of ball and roller bearings. Crown 8vo, cloth, 391 pp., with 350 illustrations. **7s. 6d. net.**

*A complete Technical Catalogue will be sent post free on request.*

**SIR ISAAC PITMAN & SONS Ltd., Parker St., Kingsway, LONDON, W.C. 2.**


## SITUATIONS OPEN (continued)

THREE Outside Fully Qualified SALES ENGINEERS (MECHANICAL) REQUIRED, with experience in sale and application of Ball and Roller Bearings, for Scotland, North of England and Midlands respectively. State in confidence, age, qualifications, and when free.—Address, P6440, The Engineer Office. P6440 A

YOUNG ENGINEER, Familiar with Problems of Heat Transfer, good address and accustomed Office Work.—Address replies, 3860, The Engineer Office. 3860 A

WANTED, DESIGNING DRAUGHTSMAN for London Constructional Engineers. Steel-framed Buildings, Factories from architects' plans. Knowledge London Building Acts essential. State experience, salary required.—Address, 3855, The Engineer Office. 3855 A

WANTED, SENIOR DRAUGHTSMAN, with Machine Tool experience, for Midlands. State full experience, age, and salary required. Also JUNIOR or IMPROVER, accustomed to Small Tools and Jigs.—Address, 3807, The Engineer Office. 3807 A

WANTED, Skilled DRAUGHTSMAN, for Yorkshire, who understands the Hydraulic Press Trade. Good and permanent position to right man. One who is accustomed to Calculating and Estimating preferred. State age, experience, and wages required. —Address, 3787, The Engineer Office. 3787 A

CONSTRUCTIONAL STEEL WORK DRAUGHTSMAN IMPROVER REQUIRED for London Consulting Engineer's Office. State experience and salary expected.—Address, P6447, The Engineer Office. P6447 A

## SITUATIONS OPEN (continued)

DRAUGHTSMAN DESIGNER, Experienced, WANTED for Commercial Chassis, Midlands. State experience, age, salary required.—Address, P6439, The Engineer Office. P6439 A

DRAUGHTSMAN REQUIRED by Large Engineering Firm in Lancashire, with wide experience of Instrument and Meter Work.—Address, with particulars of age, training, experience, and salary required, 3529, The Engineer Office. 3529 A

DRAUGHTSMAN REQUIRED, Experienced in Carbonising Plant and Coal Handling. Progressive position.—Address, stating age, experience, and salary required, P6422, The Engineer Office. P6422 A

DRAUGHTSMAN REQUIRED for Boiler Details. Please give details of experience, &c.—Address, 3851, The Engineer Office. 3851 A

DRAUGHTSMAN REQUIRED, with Experience in the design of all classes of Jigs, Tools and Fixtures, for accurate production. London district.—Address, stating age, experience, and salary required, 3848, The Engineer Office. 3848 A

DRAUGHTSMAN, with Experience in General Engineering Design, preferably Gasworks or Cement Works Plant.—Address replies, 3859, The Engineer Office. 3859 A

DRAUGHTSMAN, with Experience of Drying and Ventilating Plants, Sheet Metal Work. A knowledge of Light Conveyor Work an advantage. Good prospects for right man. Give full particulars of experience; state age and salary required.—Address, 3834, The Engineer Office. 3834 A

## SITUATIONS OPEN (continued)

JIG and TOOL DRAUGHTSMAN REQUIRED for the design of Jigs, Fixtures and Press Tools, for small and medium-size components. Factory 30 miles from London. State age, salary required, and full particulars of experience.—Address, 3847, The Engineer Office. 3847 A

JIG and TOOL DRAUGHTSMAN REQUIRED, with good experience in Tooling for Aero-engines.—Address, stating age, experience, and salary required, 3824, The Engineer Office. 3824 A

REQUIRED IMMEDIATELY, SENIOR and JUNIOR DRAUGHTSMEN, with experience in up-to-date Commercial and Passenger Vehicle Design. Permanent jobs to the right men.—Address, 3836, The Engineer Office. 3836 A

STRUCTURAL DETAIL DRAUGHTSMAN REQUIRED for Detailing Light Constructional Steelwork. Only experienced men need apply.—State age, experience, and salary required, to BOULTON and PAUL, Ltd., Riverside Works, Norwich. 3815 A

TRACER (Male), with Experience in Civil Engineer's Office, REQUIRED for London. Salary not exceeding 65s. a week.—Write, stating age, experience, &c., to Box 144, c/o R. Anderson and Co., 14, King William-street, Strand, W.C. 2. 3827 A

FOREMAN, First-class Man, for Assembly Department of Large Works specialising in the production of small articles on mass repetition basis. Only those who have successfully held a similar position need apply. State fully experience and salary required.—Address, 3826, The Engineer Office. 3826 A

## SITUATIONS WANTED

A FULLY QUALIFIED MECHANICAL ENGINEER and DESIGNER, of proved inventive ability, DESIRES POST. Exceptionally broad experience. Keen, rapid worker, possessing initiative. Efficient draughtsman; capacity for detail. Fluent French; tech. correspondent; Mem. Inst., &c. Highest references.—Address, L. M., 24, St. Mark's-road, North Kensington, W. 10. P6454 B

COMPETENT DESIGNER and ENGINEER DESIRES responsible and progressive POSITION; 14 years' experience in design and manufacture of road-making and agricultural machinery, including tar-spraying and concreting plant. Knowledge of French and Spanish.—Address, P6445, The Engineer Office. P6445 B

EMPLOYMENT REQUIRED at Home or Abroad by Civil Engineer. Experienced survey, bridges, roads, and railways. Eleven years officer Royal Engineers. Good administrator and organiser. Tactful and used to supervising large staffs. Fluent French, Hindustani, Malay, Hausa.—Address, P6456, The Engineer Office. P6456 B

ENGINEER (Scotchman) SEEKS POSITION abroad; 15 years' experience in the East in erecting and maintaining plants. Good control of native labour; also has planting experience. Fluent Malay. At present free.—Address, P6437, The Engineer Office. P6437 B

EXPERIENCED ENGINEER, at Present Chief Engr. Industrial concern, salary £750, WISHES POSITION as MANAGER. Age 42. Unimpeachable record.—Address, P6421, The Engineer Office. P6421 B

IN INDIA, THREE BROTHERS, British Graduated and commercially experienced engineers, will REPRESENT MANUFACTURERS of Liquid Fuel Engines, Electrical and Agricultural Appliances. Vast sale connections.—Address P6450, The Engineer Office. P6450 B

MECH. ENGINEER, Public School, Age 40, URGENTLY REQUIRES POST. Thorough experience of works management and commercial side of engineering. Accept position in works or sales engineer. London area preferred.—Write, Box Z. 182, Willings, 86, Strand, W.C. 2. 3757 B

PIPE LINE WELDING SUPERINTENDENT.—AMERICAN, thoroughly familiar with every phase pipe line construction, can TRAIN, DIRECT WELDING CREWS latest American practices. Conversant with oil well tool maintenance, welding as applied to pumping plant, compressor and refinery construction. Willing to go anywhere. References exchanged.—Address, P6453, The Engineer Office. P6453 B

ENGINE-ROOM ARTIFICER, Royal Navy (29), DESIRES POST abroad, shift or maintenance, oil, coal, turbines, Diesels. B.O.T. Certificate, first-class references.—Address, P6446, The Engineer Office. P6446 B

## PARTNERSHIPS

ENGINEER, Practical, Design, Consulting and Sales experience, WISHES ACTIVE PARTNERSHIP or DIRECTORSHIP, Mechanical or Electrical Business, Manchester district. Must be sound concern and open to investigation. Will invest £2000.—Address, P6444, The Engineer Office. P6444 C

## AGENCIES

A. I. MECH. E., M.I. LOCO. E., OPEN ACCEPT AGENCY for home and export markets where unique connections, technical and commercial qualifications and selling organisation could be applied to advantage. Offices and storerooms, Westminster.—Address, 3748, The Engineer Office. 3748 D

ENGINEER, M.I. Mech. E., with Connection, London and Home Counties, is considering rearrangement of agencies, would LIKE HEAR of first-class FIRM REQUIRING REPRESENTATION.—Address, P6392, The Engineer Office. P6392 D

MECHANICAL ENGINEER SALESMAN, with extensive works and selling experience, is DESIROUS of REPRESENTING a FIRM of repute in the Southern Counties. Advertiser has good connection amongst steam, electrical and mechanical engineers, municipal authorities. Whole or part-time proposition entertained on small salary, expenses and commission basis.

Address, P6438, The Engineer Office. P6438 D

REPRESENTATIVE WANTED, to Get Work for London General Engineering Works, medium manufacturing or repairs. Can handle another £10,000 turnover per annum comfortably. Send particulars and terms, in confidence.—Address, 3843, The Engineer Office. 3843 D

SALES ENGINEER, M.I. Mech. E., OFFERS Firms Requiring London Representation the advantage of PERSONAL ATTENTION and an ESTABLISHED CONNECTION among steam users in London and district. Office Central London. Substantial contracts in hand. Commission and nominal amount for part expenses.—Address, P6442, The Engineer Office. P6442 D

TWO SALES ENGINEERS, Just Forming Partnership, DESIRE PROTECTED AGENCIES. Excellent connection among engineers, factories, shippers, &c., London and Home Counties. Office provided.—Address, P6455, The Engineer Office. P6455 D

**For continuation of Small Advertisements see page 3.**

# A Seven-Day Journal

## A Bridge Building Record.

It is reported that on Tuesday, the workmen engaged on the construction of Sydney Harbour Bridge created a world's record by placing in position on an arched bridge a total weight of 570 tons of steel. The previous record for one day was 360 tons, and was established during the building of the Hell Gate Bridge over the East River, New York. The contract for the Sydney Harbour Bridge is in the hands of Dorman, Long and Co., Ltd. In our issue of October 28th, 1927, we illustrated and described the crane equipment designed and made by the Wellman, Smith, Owen Engineering Corporation, of London and Darlaston, for the purpose of facilitating the erection of the bridge. The central arch of the bridge has a span of 1650ft., a width of 150ft., and a height at its highest point of 450ft. above the water level. This arch is being erected simultaneously from the two shores of the harbour. Two crane equipments are employed on the work one for each half of the arch. Each equipment consists of an undercarriage extending across the top booms of the arch and carrying a crane equipment which can be traversed across the undercarriage. The traversing carriage is equipped with a main jib crane capable of lifting 122 tons, a "jigger hoist" capable of lifting 20 tons, two 2½-ton derrick cranes and a 5-ton "walking" crane. The material for the bridge is hoisted from the water surface below, and as it is built into the structure the undercarriage and its crane equipment is advanced along the booms. Until the halves of the arch meet at the centre of the span, each half is tied back to anchorages on the land. The crane equipment may, therefore, be said to lay its own track in mid-air.

## Proposed American Shipping Schemes.

If ships are to be found for all the thirteen new ocean mail routes which have recently been certified to the United States Shipping Board by the Postmaster-General of America, then the various shipping companies which will operate these new routes will be required, within the next ten years, to construct no less than forty vessels, aggregating about 460,000 gross tons. The estimated cost of such a building programme is given as about 50 million pounds. It is expected that work on the first seventeen ships will be begun during the next six months. Three of the most important mail routes are those for the North Atlantic, for which three services are in contemplation and are to be operated by ships of the United States lines. They include a five-day route between New York and Cherbourg, for which during the next five years three new super-liners of the "Leviathan" class will be required; an eight and a-half day route between New York and the Channel Ports, and a seven-day route from New York to London. The other ten ocean mail routes comprise sailings from various American ports to European countries and to South America, besides which there are still to be considered new services to the Black Sea and to Manilla. The total mail compensation for the thirteen scheduled routes is stated to be over 15¾ million pounds, as against a little over 1 million now paid to ships sailing on twelve of the routes. The United States Lines is already in the market for two super-liners of the "Leviathan" class, along with two 710ft. liners for its North Atlantic service. The Port of New York Authority is also making preparations for the berthing of new large liners, and it has recently purchased the Little Basin from the State of New Jersey with a view to constructing a terminal port with four piers, each 1000ft. to 1200ft. in length, which will serve the largest liners using the port.

## Engineers' Wages.

In August, 1927, the wages of plain-time workers in the engineering industry were advanced 2s. per week. In March, 1928, the unions submitted a demand for a further advance of 8s. in the wages of plain-time workers and for corresponding increases in piecework prices. This demand was based on the argument that the wages paid to operative engineers were not commensurate with the value and importance of their work, and on the additional argument that it was necessary to ensure to operative engineers a standard of life sufficiently high to make the calling attractive to intelligent youths. The employers rejected the demand on the ground that there was at that time no justification for an advance. The unions again raised the question of an increase in June this year, but the employers replied that at the moment they were unable to assess the additional burdens which Parliament was placing on industry. In order to allow them time to discover what their position would be under the legislation proposed by the Labour Government, the discussion was postponed until the end of November. On Thursday of last week the discussion was resumed. It resulted in a refusal of the employers to grant the advance. In a statement to the union representatives, Sir Allan Smith, the chairman of the Employers' Federation, dwelt on the unemployment question, the state of the export trade, and the additional burdens placed on industry by the Government's financial policy. He also stressed the significance of the disarmament policy and stated that the effects would not be confined to naval work, but would react on the land and air forces and would have extensive ramifications throughout the nation's industrial life. It was, therefore, impossible, he said, for the employers in these circumstances to place an additional burden on the engineering industry by granting the increase of wages demanded. A conference of all the unions concerned is to be called in January to consider what action should be taken in view of the deadlock which has now arisen.

## A New Union-Castle Liner.

On Sunday afternoon last, November 24th, there arrived in the Thames the new motor passenger liner "Llangibby Castle," which has been built and engined by Harland and Wolff, Ltd., for the East African service of the Union-Castle Mail Steamship Company. The new liner completed successful trials last week and left the Clyde at the week-end with a large number of guests on board. Heavy weather was encountered in the Irish Channel and when rounding Land's End, and although the vessel was in ballast, she showed herself to be a very steady ship. The principal dimensions of the new liner are as follows :—Length, 485ft., beam 66ft., depth 33ft. 6in., with a measurement of about 12,000 gross tons. With her two low funnels she presents a pleasing appearance. Accommodation is provided for 250 first-class and 200 third-class passengers, and the latest navigation and safety equipment is fitted. The main propelling machinery comprises a twin-screw arrangement of eight-cylinder Harland-B. and W. four-stroke, double-acting oil engines, each equipped with a supercharger and an exhaust gas boiler. The pressure chargers are of the Büchi type, and consist of a blower driven by an exhaust gas turbine. The heat from the exhaust gases is recovered in a Clarkson thimble-tube boiler, which is fitted with the Clyde low-pressure system of burners for port use. The main engines have a cylinder bore of 740 mm., with a stroke of 1500 mm., and at 108 r.p.m. they have a designed output of 8500 S.H.P. The service speed of the ship is about 14½ knots. There are three 250-kW oil engine driven generator sets, also a small emergency generator set. The refrigerating equipment is by J. and E. Hall, Ltd., of Dartford, the holds being steel lined. The "Llangibby Castle" is scheduled to sail from London on December 5th for Africa, where she will join her sister ships of the Union-Castle Line.

## Overhead Lines in Sussex.

Accompanied by the Minister of Transport and Sir John Snell, the Prime Minister recently received a deputation on the subject of overhead lines and towers in Sussex. The spokesman of the deputation explained that the main object of the deputation was to urge that before any irretrievable steps were taken the whole scheme as affecting purely rural districts, such as Sussex, should receive further careful consideration, since the inquiry which was held last September was unsatisfactory, and the County Councils and others interested had not had a real opportunity of hearing the case of the Electricity Commissioners and of stating their own objections. They desired to impress the Prime Minister with the disastrous effect which the scheme would have on the amenities of the Downs, and while realising that the scheme was national in conception, they were not satisfied that the inclusion of the county was essential or that the proposals of the Central Electricity Board would afford an abundant and cheap supply of electricity in rural areas. The Minister of Transport dealt with certain technical and detailed questions, and explained that he was satisfied that it was not practicable to put the requisite stretches of high-tension lines underground. It was just as essential, he explained, that Sussex should be linked up as it was that the rest of the country should be. The Prime Minister said that as a lover of the beauty of the countryside he welcomed the deputation. It was necessary if the country was going to survive as an industrial nation to have electricity, but every care would have to be taken to see that in the supply of that power the beauties of the countryside were not destroyed. He suggested that the local authorities concerned should make any representations as regarded the secondary lines, to which the deputation had referred, to the Central Electricity Board. The proposals which had been sanctioned as regarded Sussex would, of course, have to be put into practice.

## Low Temperature Carbonisation.

At a joint meeting of the Institution of Electrical Engineers and the Institute of Fuel, held on Thursday, November 21st, three papers on low-temperature carbonisation, with special reference to its combination with the production of electricity, were read and discussed. Mr. McEwen gave a paper on American practice, in which he considered the possibility of the pre-treatment of fuel with the recovery of by-products as an economic advantage in the production of electricity in the United States. He dealt mainly with the McEwen-Runge process, and emphasised the necessity for securing a maximum revenue from the sale of gas as produced by pre-treatment, and claimed that the desired result could only be obtained by co-operation with public service companies supplying gas to domestic and industrial concerns. It was necessary, he said, to produce a gas not only rich enough in calorific value, but of a specific gravity complying with the requirements of a public service company. Various combinations had presented themselves for securing that result, and preparations were in hand for the last stage of development. A paper by Professor P. Rosin dealt with the economics of the production of power and valuable by-products from brown coal, which the author explained, was very plentiful in Germany, but had an extremely low calorific value. On account of the low cost of brown coal, the works using it had gained a great advantage over those dependent on pit coal. No new processes, it was explained, had been developed in Germany since the publication of the report of Dr. Heinze to the Fuel Conference held in London in 1928, in connection with the World Power Conference. The third paper, read by Messrs. E. H. Smythe and E. G. Weeks, dealt with the Babcock process of low-temperature carbonisation. The Dunston-on-Tyne plant was designed for the production of an ideal power station fuel, low in volatiles and therefore smokeless, and for the recovery of the more valuable by-products consistently with the production of such a fuel.

## An Important Locomotive Order.

We learn that, this week, Beyer, Peacock and Co., Ltd., of Manchester, have received by cable an order from the South African Railways for six more "Beyer-Garratt" articulated locomotives, delivery to be begun in May next year. Two of these engines have already been supplied by the firm for use on the Durban and Cato Ridge deviation. So satisfactorily did they fulfil the tests to which they were subjected that within seven weeks of their being put into use an order for six more has now been placed. The Durban and Cato Ridge section has a length of 44 miles and includes about 35 miles of 1 in 66 gradients. At one time ordinary British engines of the mountain type were employed on the section and were able to handle loads of 500 tons at 14·8 miles an hour. At a later date the railway administration ordered some German articulated engines, which were designed to be capable of hauling loads of 700 tons over the section. The two new Beyer-Garratt engines now in service have on test each shown themselves able to haul a load of 1117 tons over the section at a speed of more than 16 miles an hour, and quite recently have excelled this test figure by taking a load of 1205 tons at a higher speed than was realised by the earlier types of engine with less than half the load. The new engines weigh 214 tons each and develop a tractive effort of 89,136 lb. at 85 per cent. of the boiler pressure. They are equipped with mechanical stokers and are operated by a crew of two. They are the most powerful steam locomotives yet built in Europe, and as the gauge is 3ft. 6in. they represent an outstanding development of the articulated locomotive. By their employment the capacity of the line has been doubled without an increase in the number of trains or in the size of the train staff.

## The Grampian Hydro-Electric Scheme.

On Tuesday last, November 26th, the Select Committee of the House of Lords met to consider revised proposals for the Grampian hydro-electric scheme. Speaking on behalf of the Grampian Electricity Supply Company, Mr. Tyldesley Jones, K.C., referred to the previous proceedings, which were unfortunately terminated by the sudden death of Lord Younger. In the light of those proceedings the promoters and the opposition had had an opportunity of reconsidering the situation, and in view of the agreements which the Grampian Electricity Supply Company had been able to make with many of the landowners, the character of the opposition was now very different. The company, Mr. Tyldesley Jones went on to say, was supplying electricity in many parts of the North of Scotland, and authority would be sought to construct certain additional works in Strathglass. The scheme put forward would, he pointed out, utilise natural resources and there would be no smoke or dust. Already several thousands of Highlanders had been able to secure employment connected with the manufacture of aluminium, and there was no doubt that the scheme would open up possible further employment in regions where otherwise the prospect was almost hopeless. There would be no difficulty in raising the necessary capital for the scheme and no State aid would be necessary. Authority would be asked to increase the already authorised capital of £1,750,000 to £2,500,000 and to remove the present capital limit of £4,000,000, so that further capital could be secured as wanted. The Central Electricity Board had entered into an agreement with the Grampian Electricity Supply Company to take power from the Rannoch and Tummel station not later than December 31st, 1930, and the agreement would continue until the Electricity Board's scheme for the North of Scotland was adopted, when the company's stations would become selected stations. There was an enormous field of enterprise in the extended area of supply, and the scheme had the advantage of being one which was recommended by the erstwhile Highland Development Committee.

# The Shipyard and Engine Works of J. Samuel White & Co., Ltd., at Cowes, I.O.W.

No. I.

THE shipyard of J. Samuel White and Co., Ltd., at East Cowes, in the Isle of Wight, is certainly one of the oldest in the South of England, and its association with the present firm dates back to the early nineteenth century, when Mr. Thomas White—the grandfather of the J. Samuel White whose name forms the style of the present firm—then an established shipbuilder at Broadstairs, in the Isle of Thanet, took over the business from the proprietors of Nye's Yard, in which naval ships had been built since the year

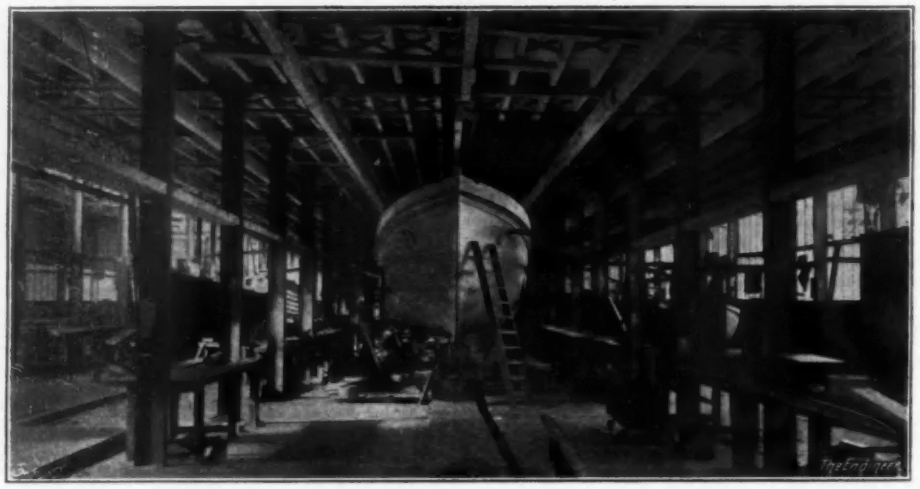


FIG. 1—THE LARGE BOAT SHOP, EAST COWES

1696. The development of the business by Mr. White, the building of the Medina dry dock, and the subsequent extensions of the ship-repairing and shipbuilding business, is well described in a book entitled "Shipbuilding: From Smack to Frigate, from Cutter to Destroyer," which was published by the firm about a year ago, and in which the war activities of the firm are also recorded. During the war Messrs. Whites contribution of new vessels alone included twenty-two destroyers, eleven patrol vessels, and three submarines, besides aircraft. In the present articles we describe the existing shipyard and engine works, as they presented themselves to us on the occasion of recent visits. Since the war, the firm has naturally adapted its plant to some extent to the building of mercantile ships and yachts, but it has, nevertheless, since 1918 completed two naval contracts of unusual interest for foreign Governments. We refer to the re-conditioning, re-boilering and re-arming of the four Greek destroyers, "Ierax," "Leon," "Aetos," and "Panther," which in 1924 were brought up to modern requirements as regards their fighting power, speed, and propelling machinery; and to an order to build three flotilla leaders for the Argentine Government which the firm secured in 1928. In these vessels there has been embodied experience gained during the war with regard to the speed and the armament of such ships. At the time when we visited the works these three ships were under construction, and some of the photographs which we reproduce show parts of their machinery going through the shops. The trials of these vessels were carried through with entire success, and the first ship to be completed, the "Mendoza," touched a maximum speed of 39 knots on her measured mile runs. The second vessel, the "Tucuman," was equally successful in her speed and power trials; while the third flotilla leader, the "La Rioja," created what is claimed to be a world record for a vessel of this class by her speed of 39·4 knots.

We may add that in 1924 there was built in the yard a noteworthy mercantile vessel, the paddle steamer "Crested Eagle," for the passenger service between London and the Isle of Thanet watering-places.

### THE SHIPYARD AT EAST COWES.

The East Cowes shipyard is situated on the east bank of the River Medina, and is opposite the engine works and fitting-out quay on the west bank of the river, to which we shall have occasion to refer in our next article. The site is one which affords ample berthage, and particularly good facilities, both for launching and timber storage. There are six building berths, four of which are capable of accommodating ships up to 350ft. in length, with a maximum beam of about 40ft. Berth No. 6 is covered in, and is somewhat shorter than the others, being employed as a general rule for yachts with lengths up to 185ft. This berth is served by a 5-ton overhead crane, and there is also a 5-ton crane for handling materials. Between Nos. 3 and 5 berths is a patented hauling-up slipway, with an electrically-operated winch gear capable of hauling up vessels of 1000 tons. The main berths are served by ten derricks and electric winches, three of which are double and seven single. Between the building berths concrete piers which facilitate the transport of the finished material, are conveniently arranged. At two of the pier heads there are electric and hand-operated cranes. The four main berths, No. 0 to No. 3, are designed to accommodate vessels up to a maximum length of 350ft. and a beam of 40ft. It was on these berths that the recent Argentine flotilla leaders were built. Additional transportable plant includes a floating pontoon bridge for landing purposes, oil barges, and a compressed air supply vessel.

Alongside No. 0 slipway there are extensive angle racks and at the southern end of the yard are large timber stores. On page 571 we give four typical views of the shipyard shops. The mould loft, which is situated at the south end of the yard over the main boat-building shop, is shown in Fig. 3. It is noteworthy for its length of 225ft., and its large area, which enables a torpedo destroyer hull to be laid down full size. The large boat shop, which runs the full length of the mould loft, is shown in Fig. 1. At the time of our visits two 50ft. steam pinnaces and a 38ft. motor pinnace were under construction. Adjoining the boat shop there is a covered slipway with three tracks which are served by two 3-ton and two

FIG. 2—JOINERS' SHOP, EAST COWES

5-ton overhead cranes. Nearby are the spar shop, the rigging loft, and a saw mill, which is specially designed to deal with bulk timber. Between the spar shop and sawmill is the joiners' shop, which is fully equipped for the manufacture of furniture and fittings for naval and mercantile ships and yachts. We noted in this department a wide range of up-to-date wood-working machinery, which are fitted with a modern dust-extracting plant delivering the refuse material to the furnaces of the heating boiler. Two views of the joiners' shop are given, one in Fig. 6 on page 571 and in Fig. 2 herewith. The saw mill machinery comprises horizontal, vertical, and rack saws, and machinery for cutting and planing deck planks and for the tonguing and grooving of boards. Another department is devoted to the production of light metal plate work, such as steel lockers and drawers and ammunition storage racks.

Two views in the main platers' shed are shown on page 571. To the right of Fig. 4 will be seen the 30ft. bending rolls, alongside of which are the scarphing, edge-planing and countersinking machines. In the lower view—Fig. 5 on page 571—there will be seen some of the punching and shearing machines, while for plate-drilling operations, we noticed a series of wall-type drills. All the plant is electrically driven, and the power, both for the motors, lighting and compressed air services, is furnished from a central power station in which there are generators and air compressors, coupled direct to Petter oil engines, and also an electrically-driven air-compressor set.

The angle smiths' shed, which includes oil-fired and coal-fired furnaces, with bending slabs at either end for frame bending and plate furnacing, is well supplied with punches, shears, drills, and sawing machinery of different types, and plant is also available for flame cutting and welding operations. Other departments in the shipyard include the blacksmiths', plumbers', and painters' shops, also a machine shop and plant repair department, and a large general store for fittings and finished material. Part of the pipe-bending work, including both copper and steel pipes, is done in the shipyard, but all the large steel and copper pipes are bent and fitted in the pipe shop at West Cowes.

### THE LIFEBOAT BUILDING DEPARTMENT.

An interesting part of the works is the department which is specially set apart at West Cowes for the building of lifeboats for the service of the Royal National Lifeboat Institution. Four views of this department are reproduced on page 582. The lifeboat building shops are adjacent to the pattern shop and store, and in them are arranged twelve building berths, in four lines, each accommodating three boats. At the time of one of our visits, ten boats were under construction, and one was being fitted out. The shop is well equipped with overhead runways—see Figs. 7 and 8—which are fitted with 3-ton blocks and which are employed to lift the heavy timbers and place the engines aboard. For launching and hauling up, there is a large winch driven by a 20 B.H.P. motor, which is shown to the right of Fig. 7. The waterside end of the shop is furnished with sliding and swivelling doors, so that there is full access to the large boat slipways in front of the shop. The boats we inspected in course of construction included Watson and Barnett type lifeboats of the 40ft., 45ft. 6in., and 51ft. classes, with single and twin propellers arranged in tunnels.

The timber required for the boats is specially selected by the R.N.L.I. to meet its own specifications, and it is seasoned and conditioned both in rough and finished form in large stores which are situated alongside the boat-building shops.

For the keel, teak and cast iron are employed, and the stem and stern posts are made of English oak. Above the building berths, as our illustrations, Figs. 8 and 10, show, there are overhead woodbeams, which are employed for supporting the temporary framing moulds.

The main timbers or ribs are of Canadian rock elm, and are shaped by steaming in a kiln for a period of about two hours, after which they are bent to shape on a special saddle. After the stringers, keelsons, gunwales and ribbands have been fitted, the boat's skin, which takes the form of double diagonal planking of Honduras mahogany, is put on. It consists of two thicknesses with diagonal joints at about 90 deg., which are secured with clenched copper nails and screws, and fitted with a layer of calico between.

The fenders are then attached, and the bulkheads

# THE SHIPYARD OF J. SAMUEL WHITE AND CO., LTD., EAST COWES, ISLE OF WIGHT

FIG. 3—VIEW OF MOULD LOFT

FIG. 4—PLATERS' SHED WITH PLATE BENDING ROLLS

FIG. 5—PLATERS' SHED WITH PUNCHING AND SHEARING MACHINES

FIG. 6—PART OF THE JOINERS' SHOP

and cabins fitted. All the bearers for the motors are made of wood, but they are topped with steel angle bars to receive the motor bed-plate. The bearers are firmly bolted to the main timbers, and when the engines have been lifted in, the steel casings shown in the foreground of Figs. 9 and 10 are placed in position. All boats are fitted with self-emptying cock pits, with brass relieving valves, and access to the cabins is afforded by water-tight scuttles. In order to give the requisite buoyancy, all side spaces in the boat are fitted with suitably shaped air cases. These cases, of which there are over 150 to each boat, are made in ⅜in. deal, secured by copper nails, which is afterwards calico covered and waterproofed with marine glue. Before fitting, each case has to undergo complete immersion in water for two hours. Special arrangements are made to ventilate the compartments in which the air cases are fitted. During the past nine years Messrs. Whites have completed no fewer than forty-two motor lifeboats. Before this time several steam-propelled lifeboats were also constructed. During construction the boats are thoroughly inspected by the Royal National Lifeboat Institution's resident overseer's staff. They then undergo a series of sea trials of a very thorough nature, prior to their dispatch to the service stations.

### The Southampton Repair Works.

Although from what has already been said, it will be clear that the East and West Cowes works of the firm are fitted out in such a way that all kinds of ship and engine repair work can expeditiously be carried out, it was eventually decided by J. Samuel White and Co., Ltd., in view of the large amount of work which has to be done on ships which dock at Southampton, that it would be advantageous to have a complete repairing plant centrally situated at the Southampton Docks. Extensive repair shops were therefore erected, close to the Prince of Wales Dry Dock, and were laid out to deal with all kinds of ship repairs. The hull repair section of these works includes a 30ft. oil-fired furnace, a plate mangle, a 30ft. edge planer, and 21ft. rolls, as well as the usual punching and shearing machines, and vertical, countersinking, and drilling machines. Alongside this department is the smiths' shop, which is well equipped with power hammers. Facilities are provided for carrying out coppersmiths' work in a specially laid out shop. For the preparation of woodwork and patterns, there is a large joiners' and pattern-makers' shop, with a varied assortment of motor-driven wood-working machinery. The main engine fitting and machine shops are equipped with several large lathes, the largest, which has a swing of 72in., being designed to take parts weighing up to 25 tons. The usual range of machine tools is provided with special plant for pipe screwing and other operations associat d with ship repair work. The larger shops we have referred to are well served by overhead cranes, and there is an extensive storage space with provision for such additional plant as portable air compressing and welding equipment.

The Southampton repair department is kept in close touch with the main works by the fleet of the Island Transport Company, which is owned by Messrs. Whites, and includes two motor vessels, barges and suitable road transport vehicles.

*(To be continued.)*

## The Modernisation of Japan.

*(By the Special Correspondent of* The Engineer.)

According to the daily Press, of a total of over 750 papers contributed to the World's Engineering Congress in Tokio, over 300 were by Japanese engineers and chemists—professors at the universities and technical schools, works engineers, research workers.

We who live in Japan, and are more or less familiar with the people, perhaps, do not rate at its true significance and value the character of the remarkable transformation which the cycle of sixty years has effected in the lives of the people of Japan. As we scan the annals of this modern era, we are impressed by a few outstanding facts. We realise first the actual terror created by the threat of national extinction or enslavement that accompanied the visits of Western peoples in powerful ships of war, and the feverish efforts made to guard against that peril. The lesson of material power so forcibly taught by American, French, Russian, and British warships sank deeply into the Japanese mind, and it is not without significance that this people, more than any other in modern times, has been newly created, new made, by war.

Despite all we hear to the contrary about the injurious effects of war, few will deny the assertion that war has been the making of modern Japan. The "black ships" of Commodore Perry first stimulated a people sunk in sloth and ruled by a code Perry has himself described as the most cruel in existence, a people who lived in fear and absolute subordination to a military oligarchy. But the rude awakening electrified them, and set them on the Western road of learning, though much blood was shed and many statesmen and lesser figures were martyred by the half-savage reactionaries who resented the invasion of the Western barbarians and bitterly opposed the policy of those who saw salvation only in meeting the foreigner half way. Twenty years of persistent and violent opposition, however, with continuous internal warfare, failed to turn the leaders of the nation from the new course decided upon. Japanese, anxious to see the great world, violated the laws of their country and stole away daring the penalty of death. They returned to be the greatest of Japan's modern statesmen. Officially appointed "missions" visited Europe and the United States, "seeking knowledge in all lands," as the people were later commanded to do by an Imperial Rescript which in Japanese eyes to-day bears the sacred character of the Magna Charta of the Britons.

### A People Made by War.

Let it be repeated that war has been the great stimulator of the Japanese nation, the creator of trade and industry, and the lever by which the nation has acquired its empire, which now stretches from the mandated islands of the "South Seas" to the confines of Mongolia and the Arctic Circle. Japan's first foreign war was that in Formosa in 1874; a small affair, a matter of subduing savages, but involving the risk of trouble with the giant overlord of the island, the Emperor of China. Japan sought to punish the Formosan aborigines for exactly the same reason that brought Commodore Perry to these shores in the 'Fifties of last century, the barbarous usage of seamen castaways. In this campaign the Japanese forces and the conduct of the expedition made a most favourable impression upon the one foreign observer attached to the staff,* and that has been the verdict of all foreign observers in every war in which Japan has engaged.

Recent wars have occurred at intervals of a decade—the Japan-China War, 1894; the Russo-Japanese War, 1904; and the Great War, 1914.

The peace with China, accompanied by the annexation of Formosa and a substantial indemnity, may be regarded as signalling the beginning of Japanese modern industry, most particularly the shipping industry. It was at that time, when foreign ships had to be chartered by the score at fancy rates, that the Japanese Government realised the disadvantages of dependence, and a great spurt was given to infant shipyards, which now rank with the best in the world. In the ensuing years, shipbuilding laws and laws for the encouragement of navigation were enacted. Under them substantial bounties were granted to builders and owners. They have been periodically amended to suit developing conditions, and now benefit chiefly the great ocean services which, without heavy subsidies, could not be maintained in competition with foreign lines.

### The Industrial Road.

Japan was well on the modern industrial road when the Russo-Japanese War called forth the supreme energies of the people. Whatever that war was for Russia, for Japan it was a matter of life and death, and it ended with the nation acclaimed by the whole world as a great people, if not a Great Power.

Extraordinary activity followed the Peace of Portsmouth in every branch of industry. Japan's prentice hand has been often tried, and will continue to be tried, but what other nations lack, the Japanese have to an extravagant degree, the assistance of the Government, without which, it may be affirmed, little progress would have been made in any direction. This fact has been proved—and it is generally admitted by the Japanese themselves—by the whole shipping industry, which was not only carefully reared in infancy, beginning with the construction and navigation laws of 1896, but has been carefully nursed since, and has thus been able to meet the enormous demands made upon the national shipyards during and immediately after the late war, when construction was ten times its present amount.

It was during the era of the Russo-Japanese War that the Government created the monopolies, whereby tobacco cultivation and selling, camphor, and the railways came under official control. These Acts provoked a storm of foreign criticism at the time, and directed attention to the peculiarly paternal, not to say autocratic, character of the Government of Japan, but few will deny to-day that the railways, for example, have benefited by nationalisation.

Before nationalisation a financier from Australia looked over one of the longer lines with a view to a loan, and after investigation he decided that business could not be done. What he saw in those days were engines which apparently were never cleaned, wooden station erections that were strangers to paint, and a general lackadaisiness about things, thoroughly characteristic of Japanese ways, if those things are not under Government control. As it is claimed for the Japanese Navy that it is *sui generis*, so it may be claimed that the one infallible way of salving any large undertaking in Japan which is suffering from mismanagement is for the Government to take it over. Unlike his brother in China, who seems to be debased when he enters official life, the Japanese, when he enters, however remotely, into the Imperial service, whether he be policeman or premier, is a man transformed. The iron rule of the bureaucracy has him in its grip.

Thus, under nationalisation, developments quite beyond the abilities of the unofficial Japanese have taken place. Remarkable engineering undertakings have been accomplished, and the unparalleled disaster of 1923 proved the qualities of the Japanese when under official discipline—the only discipline that counts. Seventy-five miles of railway track in the neighbourhood of Tokio and Yokohama were torn up, twisted, engulfed, embedded; culverts and bridges were destroyed, and stations wrecked. The Japanese engineer faced an appalling situation. It is probably correct to say that nothing in the history of engineering construction equals the task which the Japanese have accomplished in the six years that have passed since those terrible days. Stations large and small have been rebuilt, many miles of track electrified, great power houses established, double track lines quadrupled, and new signalling apparatus installed. An achievement possible only on a nationalised system was the equipment with automatic couplers of 50,000 wagons in twenty-four hours without any interruption of traffic.

Japanese engineers are familiar with tunnel boring, for the railways are riddled with tunnels, if the paradox may be allowed. They are everywhere, and before the days of electrification they made travelling a constant pain. But the engineers have set themselves a formidable task in the boring of the longest tunnel in the empire—the Tanna tunnel, nearly 6 miles long, by which the heavy gradient from Kodzu to Mumadzu, passing the base of Fuji, will be avoided, and 30 minutes saved on the main trunk line. Before the beginning, in 1918, of what has proved a gigantic task, unofficial opinion cast doubt upon the feasibility of boring through a mountain in the very centre of the volcanic zone. Experience has revealed tremendous difficulties, and no private company would have persisted as have the railway engineers.

This tunnel is now three-quarters finished, and the engineers believe that they have overcome the greatest difficulties, and will not again have to battle with the movement of masses of volcanic rock and great bursts of subterranean waters.

The site of this tunnel is very near the epicentre of the earthquake movement of 1923. As the toilers, working from both ends, dug deeper and deeper into the bowels of the mountain, they were soon made to realise that they had entered a volcanic hell. Repeated caving and sliding masses of loose rock, earth and clay, with terrific gushes of water, took their toll of lives. In one of these disasters, seventeen men were smothered or drowned on the spot, and twenty others were rescued alive or dead after a week of herculean labour. It took a year to recover the ground lost by this slide. The full story of this drama of man's struggle against the powers of Nature has never been told.

Across the city of Tokio, the main trunk line of the system is carried on an elevated railway built of brick, and it must be accepted as testimony to the engineering skill of the railway engineers that not a brick was displaced by the disaster of 1923, though throughout its whole length the city was laid low by fire. Similarly, the central station, a huge but unattractive and most inconvenient building, also of brick, passed unscathed through the ordeal, and judged by these proofs of ability, the workers in the depths of the Tanna tunnel may be depended upon to do their job, and bring it to a successful end.

Could the English engineers who assisted in the construction of the first railway opened in 1872 but revisit the scene of their labours, words would fail them. In place of the dignified English termini at Tokio and Yokohama, recalling Euston, they would see modern developments that would temporarily paralyse them. Their state of mind would be that of the foreign engineer who came recently in Japan to look things over. At the end of months of inspection of engineering works, a little man with bright eyes behind glasses asked him if he was an engineer. "I was until I came to this country!" replied the visitor.

Japan is full of contrasts, the most up-to-date alongside of what should not be tolerated in a civilised country.

### The Inquiring Mind.

The Japanese are not accounted an inventive people, and their own consciousness of this drawback is attested by the formation, some years ago, of a society to encourage invention (*Hatsumei-kai*), but anyone familiar with the technical Press and publications will know that if they do not invent, they strive mightily. And it is not quite accurate to say they are not inventors, for we are all familiar with inventions bearing Japanese names which were before the public years before the nation reached its present unpleasant state of consciousness in regard to its efficiency, or inefficiency, *vis-à-vis* Western nations. The Murata rifle, Shimose powder, the Yamada balloon, and the Miyabara boiler were useful inventions in their day; the modern list is endless, not so strikingly of invention as of improvements upon the inventions of others. As soon as anything new arrives in Japan it is taken to pieces and studied; it has happened that inquiring minds have been unable to put together again what they so eagerly took apart.

Official service, of course, attracts the brains of the nation. It is stated by Japanese writers that the latest warships, particularly submarines, are second to none, and supreme products of Japanese

* "The War in Formosa." E. H. House. Tokio, 1875.

inventive skill. Whatever be the actual position, no one at all familiar with the Japanese can doubt that they are quick to adopt and adapt new ideas, not being at all deterred by questions of the rights of others, and tireless in quest of improvement—qualities which may serve to make up for any lack of the inventive mind. The ethics of this matter are not discussed here, and even if the writer had the ability, the differences between the moral codes of Oriental and Occidental are too profound for cursory treatment.

Recent Japanese inventions (or improvements on the inventions of others) cover the whole engineering field—the improvement of turbine blades, the production of extra high-speed slow-motion cinematograph cameras, a new coinage metal, a new telegraphic calling device, new systems of electric transmission, new oil circuit breakers, new ideas on cavitation, wind tunnels, aero engine noises, new ideas in chemistry.

### The Electrical Field.

Japan ranks third as a user of electrical power, and at the present rate of progress will undoubtedly pass Germany soon. Her sixty millions of active people must be served.

In Japan every house has a clock, and every clock is wrong. This undoubted fact testifies to a certain quality of mind that is more easily observed than described or analysed. The people have a penchant for the "latest," whatever the latest may be, and regardless of its suitability, which always seems a secondary consideration. The first steam roller imported into Japan had hardly arrived on the streets when it suddenly disappeared, and it took weeks for the engineers of Tokio to resurrect it. An Irish engineer representing one of the old-established English firms passed the derelict every day on his way to the club for tiffin, and it furnished him with jokes until he died in the earthquake. But the Japanese can only learn by experience. Their main streets are now well paved and will bear many steam-rollers, but a demonstration from the massive importation from the West seemed necessary before the fact could be driven home with suitable force that the Imperial capital was without roads.

Compared with the Japanese the English are a conservative people. Here, the old gods are constantly being tumbled over, and the dead past is stone dead.

Japan is blessed by electricity—it is the people's Lady Bountiful. Electric light is installed in 88 per cent. of the houses of the nation, 10,500,000 households being so equipped. The statistician further informs us that Switzerland is the only country in the world with a larger proportion of houses electrically lighted.

The largest electrical company in the world, in point of capital, is in Tokio, its authorised capital being over £70,000,000 sterling. There are six companies, each capitalised at over 100,000,000 Yen, and fifteen with a capital of over 50,000,000. The total authorised capital of the electrical industry is over £400,000,000 sterling; over three-quarters of which is paid up. This capital is earning an average of 10 per cent.

Apart from lighting, which is practically universal, the use of electricity for every sort of purpose—for light, heat, and power—is extending in such a degree that the leaders of this new industry prophesy that it will not be many years before it supersedes all the older methods of lighting and heating because of its immediate availability, cheapness and cleanliness.

A curious and wasteful practice in Japan, invariably noted by the tourist, is the result of automatic lighting in small households, the control being at the central power station, so that the light burns all night. It is turned on and off at fixed hours, morning and evening, and householders cover it up at night with paper or cloth during sleeping hours. Possibly the companies can defend this system despite its wastefulness. The low rate paid averages 30 sen—about 7d.—a month, while the average household with a a meter pays 2 yen per month.

Electric light and power have invaded the last stronghold of Japanese conservatism, the agricultural industry, where small power machines are now doing the work of reaper and binder. Japanese engineers are now meeting the whole demand for machines formerly imported.

Electric light is being used most effectively against noxious insects. For generations the familiar "scarecrow" has dominated the fields and still does in the daytime, but this gentleman is not of much use on summer nights, when the air is alive with the humming of myriad insects. One species was so destructive to the young rice plant that in some districts the farmers calculated to lose 20 per cent. of their crops from its depredations. Oil lamps were suspended above the fields, but they have now been superseded by powerful electric bulbs, with complete success. The bulb is suspended about 10ft. above the field, and below it is a large basin filled with water, so that there is a double attraction, impossible with an oil lamp. The insects are drawn to the light above and to the water below, where the light is reflected, and at a small outlay the farmers now harvest practically the whole crop—an effective demonstration of the value of electricity.

The "heavy" electrical industry is rapidly becoming native to Japan—huge power works in remote mountain regions are equipped from Japanese factories, and are now exclusively the work of Japanese engineers. These developments are conspicuous wherever there is water power to be harnessed, and great schemes are on foot for the conversion of the remaining power. Within a decade Japan will be electrically equipped as no other nation.

### Other Industries.

Similar developments in other branches of industry can be recorded. Textile production in 1917 was valued at 720 million yen; in 1928 at 1460 million yen, and on this the Japanese set great store, considering the inexhaustible markets in China, India, and what they call the "South Seas"—the Dutch East Indies, Philippines, and their mandated territories north of the Equator. Other comparative figures are significant of progress, such as the following :—

| | | | |
|---|---|---|---|
| Silk exports .. .. | 1914 .. .. | 160,000,000 yen |
| | 1928 .. .. | 788,000,000 yen |
| Cotton yarn .. .. | 1909 .. .. | 130,000,000 yen |
| | 1926 .. .. | 730,000,000 yen |
| Pig iron .. .. .. | 1913 .. .. | 3,000,000 tons |
| | 1928 .. .. | 9,000,000 tons |
| Steel .. .. .. .. | 1914 .. .. | 280,000 tons |
| | 1928 .. .. | 1,650,000 tons |

The industrial revolution is producing scars all over the countryside, and the effects are most noticeable between the great cities of Tokio and Yokohama and Osaka and Kobe. Between the capital and Yokohama, some 16 miles of what were so recently smiling fields and villages, are now an almost continuous array of factories more or less connected with the electrical industry, in which Japan seems destined to excel.

### Reconstruction of Tokio.

What of the capital of the Empire, now emerging from the greatest disaster that ever overtook a great city?

"No city in the world has ever attempted to carry out a reconstruction plan on such a scale as this"—the words are from a paper read at the Engineering Congress. The writer compares the area of the disastrous fires of history with that of Tokio, stating that the area destroyed in Tokio was nineteen times that of the great fire of London in 1666, four times that of Chicago in 1871, and two and a-half times that of San Francisco in 1906.

Tokio to-day is the architect's paradise or inferno, according to the state of mind of the observer. It is a most extraordinary medley of unrelated buildings, set on newly widened streets, huge steel-frame structures of brick, stone, or concrete—ugly buildings, handsome buildings, some of which look as if they had dropped on the spot from some other country, so little related they seem to their surroundings.

The city is leaving a tremendous bill for posterity to pay in connection with reconstruction, and the financial position is serious, so much so, that it is in default in the interest on Government advances. The new mayor is dealing with municipal problems vigorously and in a straightforward manner, and in so doing incurring the enmity of the Tammany cliques who have ruled for so long, and by their extravagance have created a serious situation.

His Imperial Highness Prince Chichibu addressed the members of the Engineering Congress on the opening day in a new municipal hall, rushed to completion for the meeting. This building is the gift to the city of a deceased banker who recognised that the city lacked a place for great public meetings and other gatherings. The building was begun some years ago, but construction was delayed in consequence of the city authorities insisting upon a stronger foundation, the ground about having subsided considerably when work began on the foundations. Unlike other great buildings, it is Japanese work throughout, and no doubt possesses striking features. It is one of the few buildings in the city with a clock tower, is of brick, and rather extraordinary design, being as high as the city regulations allow, about 90ft., though the tower is much higher.

The Committees of the Congress sat in the small Diet building nearby, which was built in 1925, following a fire which destroyed the old Queen Anne structure, erected in days when everything English was the vogue. The huge new Diet building, which will rank as the largest parliament house in the world, was an object of supreme interest to the members of the Congress. It was begun in 1918, after a competition confined to Japanese architects and engineers, and it is expected to be completed in 1932. It occupies a dominating site overlooking the Imperial Palace, and about it all Government Departments of State are to be built in the next few years—these Departments at present being scattered all over the city, some in temporary wooden structures, of vast extent, put up hurriedly after the earthquake. The city is undergoing transformation, and before another decade is passed the whole world of architecture will be coming to the capital of the Empire of Japan to look and wonder.

---

The Provincial Air Service, Ontario, aviators have put in a total of 11,500 flying hours since May 1st, and have covered approximately 850,000 air miles, all previous records having been broken, without a single injury to any member of the service or any passenger.

## A Visit to the B.T.H. Works.

During a visit to the British Thomson-Houston Company's Rugby Works on Friday of last week, a method of making high-voltage measurements from the low-tension side of an alternating-current system was brought to our notice. By connecting voltage transformers to the low-tension side of a power transformer winding, and by providing means for compensating the errors due to the transformer regulation, the use of super-voltage transformers for measuring purposes is avoided. Voltage compensation is achieved by placing an impedance in each phase of the secondary side of a voltage transformer connected on the primary side to the low-tension side of a power transformer. The impedance has a value proportional to that of the power transformer, both as regards resistance and reactance, and is energised by a current that is also proportional

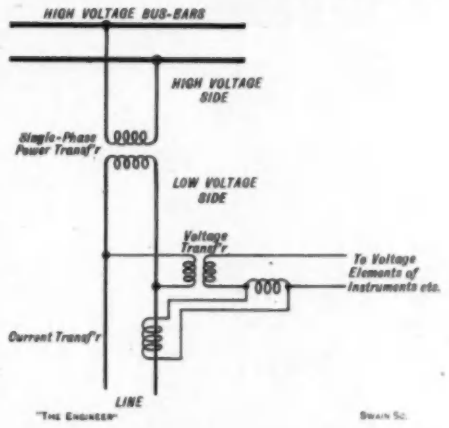



Fig. 1—Elementary Voltage Compensation Scheme

to the load current passing through the power transformer, so that the compensating circuit is a homologue on a reduced scale of the power transformer circuit. In this way a voltage drop is obtained across the impedance that is proportional to the voltage drop in the power transformer under all conditions of load. Thus, the voltage drop is suitable for correcting the secondary voltage error of the voltage transformer due to the regulation of the power transformer, and thus produces a compensated secondary voltage which is a true representation, both in phase and in magnitude of the voltage on the high-tension side of the power transformer.

An elementary application of this voltage compensation scheme to a single-phase power transformer circuit is shown in Fig. 1, from which it will be observed that the compensating impedance is energised by a current transformer connected in the low-tension side of the power transformer circuit. It is usually preferable, however, to combine the impedance and current transformer in a single unit, as shown in Fig. 2, thus simplifying the con-

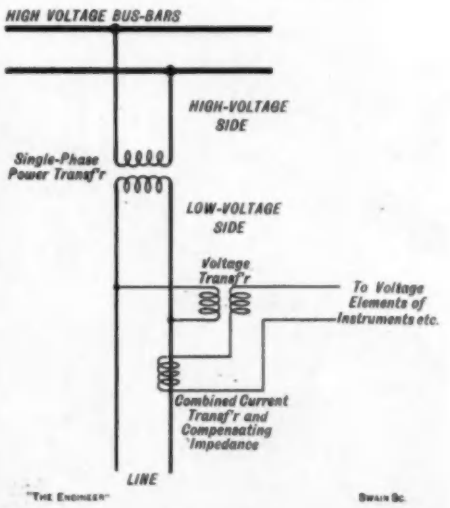



Fig. 2—Combined Current Transformer and Compensating Impedance

nections. A super-voltage transformer generally has its windings star-connected on the high-tension side, and delta-connected on the low-tension side. For this condition, the impedance should be inside the delta of the low-voltage windings and the voltage transformer should have its primary windings connected in delta and its secondary windings in open-star. But this arrangement presents difficulty, and a scheme has been evolved which enables the impedance to be connected outside the delta, as shown in Fig. 3, where it will be seen that the line current transformers and impedances are combined into single-phase units, each unit being divided into two sections, so that the compensating impedances can be connected in "zig-zag" formation. Each half section is provided with an auxiliary winding excited from a current transformer connected in the neutral on the high-tension side of the power transformer. The neutral point of the zig-zag connected impedances would always correspond to the centre of gravity of the low-voltage triangle, but that would not correspond to the position of the neutral within the high-voltage triangle. The purpose of the auxiliary windings is in effect to move the neutral point of the imped-

ances to a position corresponding to that of the high-tension side. It is, of course, understood that the movement of the power transformer neutral is determined by the magnitude of the current flowing in the neutral, and accordingly a current transformer connected in this neutral supplies the requisite current to affect this change. Actually, these auxiliary windings move the low-voltage triangle and not its neutral point, but the relative effect is the same as if the triangle were kept stationary and the neutral point moved within it. While there are means by which the low-voltage neutral can be moved instead of the triangle, they involve complications which are eliminated by the method shown in Fig. 3, which provides a triangle of secondary voltages with a neutral point that under all normal and abnormal conditions of service corresponds exactly to the high-voltage triangle and its neutral; in other words, the secondary voltages are always a faithful reproduction of the high-voltage con-

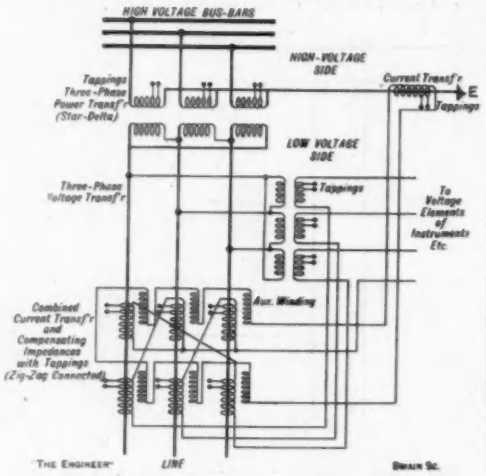



FIG. 3—PRACTICAL APPLICATION OF VOLTAGE COMPENSATION.

ditions. No matter whether the current transformers and impedances are separate or combined into single units, the effect is always to introduce a constant value of impedance into the secondary circuit of the voltage transformer, irrespective of the compensating effect due to the load current through the power transformer, and this constant impedance effect produces a ratio and phase angle change in the same manner as would be caused by any other impedance connected in the secondary circuit. The value of impedances should be kept as low as possible, the only limit in this direction being the current conveniently obtained for energising the impedances, for the lower the value of the latter the higher the current required.

The scheme has been incorporated in every sub-station so far considered for the 132-kV national scheme, the compensated voltage obtained being used for protective devices and for synchronising purposes. The British Thomson-Houston Company has also received an important order which involves the application of the scheme to automatic regulation of the high-tension voltage of groups of generator step-up transformers. It will, of course, be understood that, with these voltage compensating devices, the voltage applied to the regulator can be taken from the low-tension side of the group. The scheme is also being used for metering purposes on super-voltage circuits without the use of voltage transformers directly connected across such circuits.

At the British Thomson-Houston Company's Rugby works a test circuit has been arranged, as shown in Fig. 4, and so far as values of line current and power transformer reactance are concerned the tests carried out with the apparatus are representative of the actual service conditions. Voltages, however, are on a considerably reduced scale, thus enabling direct readings of the voltages on the high-pressure side to be obtained, so that the accuracy of the voltage readings obtained, *viâ* the compensating devices, can readily be checked. The rating of the compensating device itself corresponds exactly with the rating of apparatus being supplied to one of the sub-stations for the South-Eastern Electricity Scheme. It is for a 15,000-kVA transformer bank, and the currents on the low-tension side are the lowest, thus imposing the most severe conditions as regards accuracy of the compensating device. The secondary of the voltage transformer is also loaded to correspond to service conditions. The power transformer is rated at 75 kVA, and has a ratio of 660/165 volts and 10 per cent. impedance is obtained by the use of separate reactors. One set of voltmeters is directly connected to the high-voltage side, thus giving a direct reading of the line and phase volts, whilst a second set of voltmeters is operated by the voltage compensating device, and these voltmeters are scaled to be direct reading for the high-

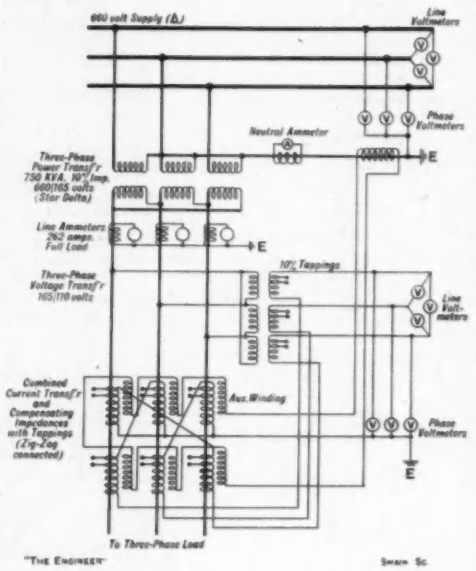



FIG. 4—TEST CIRCUIT

voltage side and are placed immediately under the corresponding voltmeters reading direct from the high-voltage side. The accuracy of the voltage compenating device is accordingly demonstrated by comparison of the two sets of phase and line voltmeters. Ammeters are connected in the low-voltage lines and in the high-voltage neutral, and a power factor indicator is also provided to indicate the power factor of the load on the low-voltage side of the power transformer. During our visit to the B.T.H. works, various tests were carried out, and in all cases, with the compensating gear in operation, the readings of the meters on the low-tension side of the transformer corresponded with those on the high-tension side.

After this demonstration we visited the transformer department—see Fig. 5—where we found many interesting transformers in the course of construction. Transformers with on-load tap-changing gear were in evidence. The total capacity of these transformers already built and on order represents over one million kVA. The firm has made the first 110,000-volt instrument transformer to be constructed in Great Britain, and the largest and highest voltage auto-transformer so far built in this country, this transformer being used with a 12,000 kVA, 22,000-volt synchronous motor. Mention should also be made of two single-unit 500,000-volt testing transformers and a million-volt single-unit testing transformer. The company claims that the first air-jet cooled transformer made in England was a B.T.H. product, and for several years was at its self-cooled rating the largest self-cooled transformer in the country. At the present time, a transformer is under construction which will operate continuously at $433{,}000/\sqrt{3}$ with the neutral solidly earthed. Besides orders for 132,000-volt transformers for the grid scheme (North-West England and North Wales area and the Central England area), the company is dealing with a contract for lower voltage transformers. The aggregate capacity of the 132,000-volt transformers is some 83,000 kVA in thirty-four units ranging from 15,000 kVA three-phase to 60,000 kVA three-phase.

The transformer department consists of a large shop used mainly for assembly and test, and various contributory departments. The large shop for assembly and test has side galleries for winding, wire covering, copper working, &c., and separate stores and office accommodation. The contributory departments include the punch shop, where core laminations are cut, the enamelling section where the laminations are coated with insulation and the tank shops where tanks, radiators and conservators are made. Oil-filled bushings are manufactured in the Willesden switchgear factory and tap changing-on-load equipments in the control gear factory in another part of the Rugby works. In spite of the diversity of transformer design, continuity of flow of the various parts which go to make complete transformers has been achieved to a notable extent. The materials enter at the south end of the main building and leave at the north end as a finished product. At the south end of the main building are the winding lathes for heavy winding, and alongside them are the treating tanks into which the coils pass after being wound. Further up the shop is the core assembly area, where the cores are built up on carefully levelled tables set solidly in the ground. By means of this equipment "wavy cores" are practically eliminated. Beyond the core assembly section the coils are assembled on the cores, while alongside this area, and thus feeding broadside into it, are the stores for the various detail parts and also the "hot stores" for insulating materials, the "hot stores" being a storeroom which is maintained above room temperature to ensure that all fibrous materials are dry when built into the transformer. Adjacent to the assembly area is the tank area, where tanks are received and examined for cleanliness and the core and coils assembled in them. Near this area are the drying ovens and vacuum tanks for vacuum oil treatment of the core and coils before they are tanked. The transformer has only to be moved a few yards to reach the testing area, and after testing the movement is sideways into the painting area. When painted, the transformers are ready for dispatch, rail sidings running into the shop only a few yards from the painting area. Thus it will be seen that the whole lay-out has been arranged so as to minimise handling operations, and it is only on very rare occasions that it is necessary to transport a complete transformer over other transformers under construction. The floor space is thus used in the most economical manner, while handling charges and the possibility of damage owing to transportation within the factory are reduced to a minimum.

Many interesting features present themselves in connection with the manufacture of large B.T.H. power transformers. Experience shows that damage to the insulation, and eventual breakdown, may be caused through ragged edges, or slivers, on the copper conductor, and it is therefore standard practice at Rugby to clean and burnish the whole of the conductor carefully before insulation. The conductor is first bent in one direction and then passed through rotating brushes. It is then cleaned, bent in the reverse direction, and submitted to a repetition of the process. In order that the copper dust created may not be dissipated into the surrounding atmosphere the processes are carried out in exhausted chambers, and, as an additional precaution, the complete machine is placed in an exhausted compartment, as shown in Fig. 6. The conductor thus prepared is then passed through an insulating machine, where it is wrapped with the required number of layers of pre-treated paper insulation. This pre-treatment consists of cutting into exact widths and vacuum drying, and is followed by impregnation in order that all moisture may be removed from the paper before it is wrapped on the conductor. It has been found that the usual lap joint strains the paper and entraps small quantities of air, which on high voltage transformers may become ionised and cause cracking of the paper insulation where it is strained, and for this reason the British Thomson-Houston Company has developed a special method of applying paper insulation wrapping which overcomes the difficulties. The conductor thus insulated is covered with cotton strands in order that it may receive a mechanical protection; but this covering is not considered to possess any electrical insulating properties.

It is standard practice to weld electrically all joints in the winding. The joints thus made have a mechanical

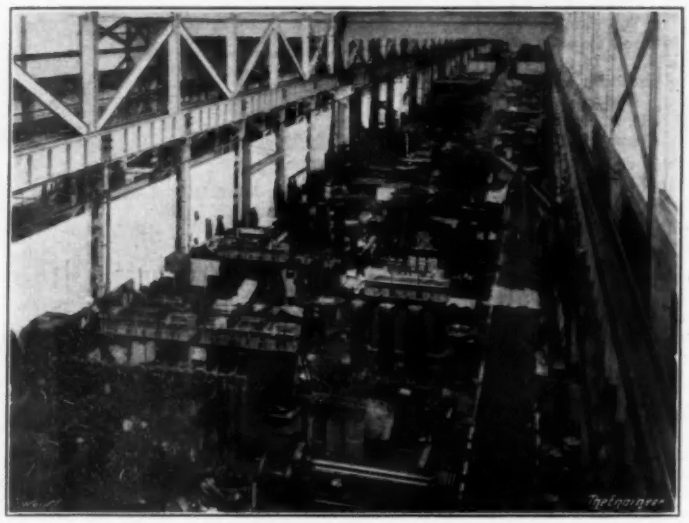


FIG. 5—VIEW OF TRANSFORMER DEPARTMENT

FIG. 6—PLANT FOR CLEANING CONDUCTORS

## THE RUGBY WORKS OF THE BRITISH THOMSON-HOUSTON COMPANY, LTD.

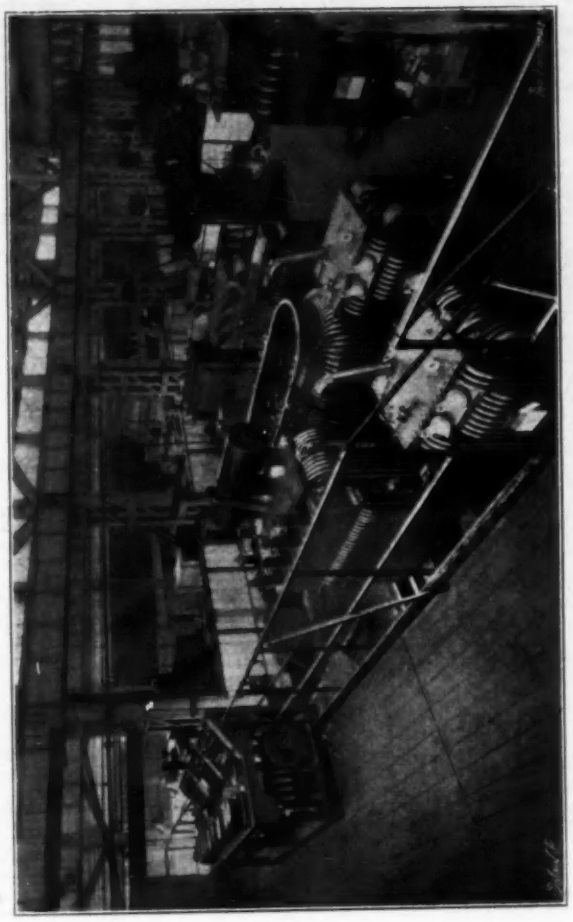


FIG. 8—PART OF TRANSFORMER TEST-CONTROL GALLERY

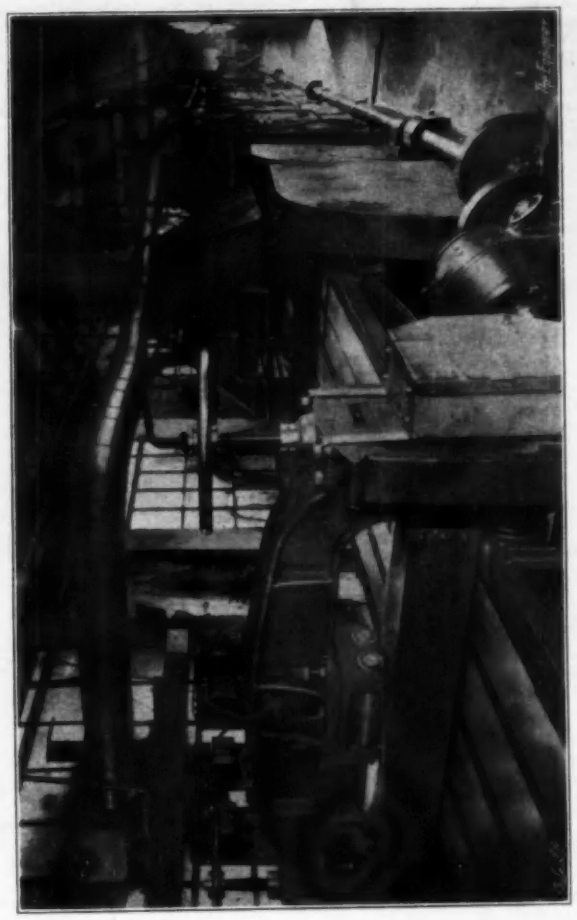


FIG. 10—MACHINE FOR COATING CORE LAMINATIONS WITH VARNISH

FIG. 7—TRANSFORMER TEST-CONTROL GALLERY

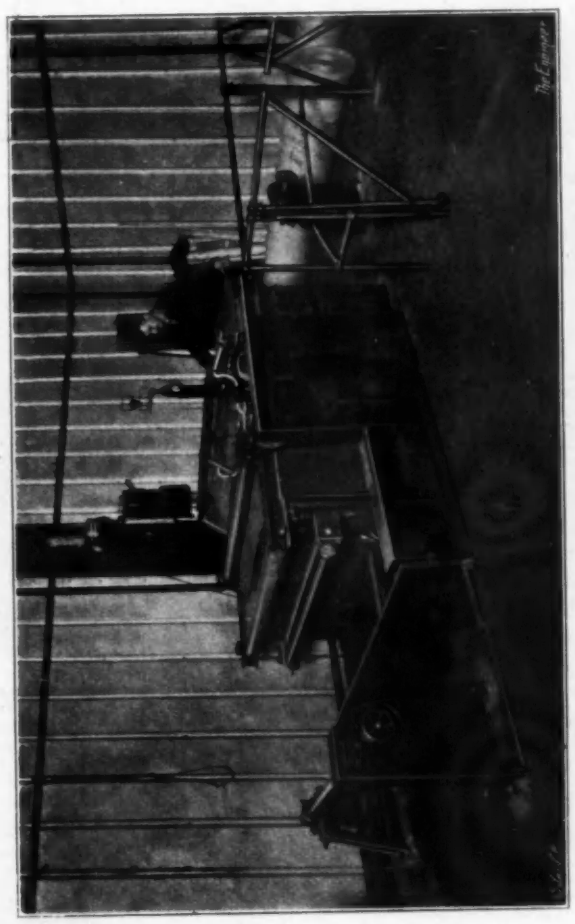
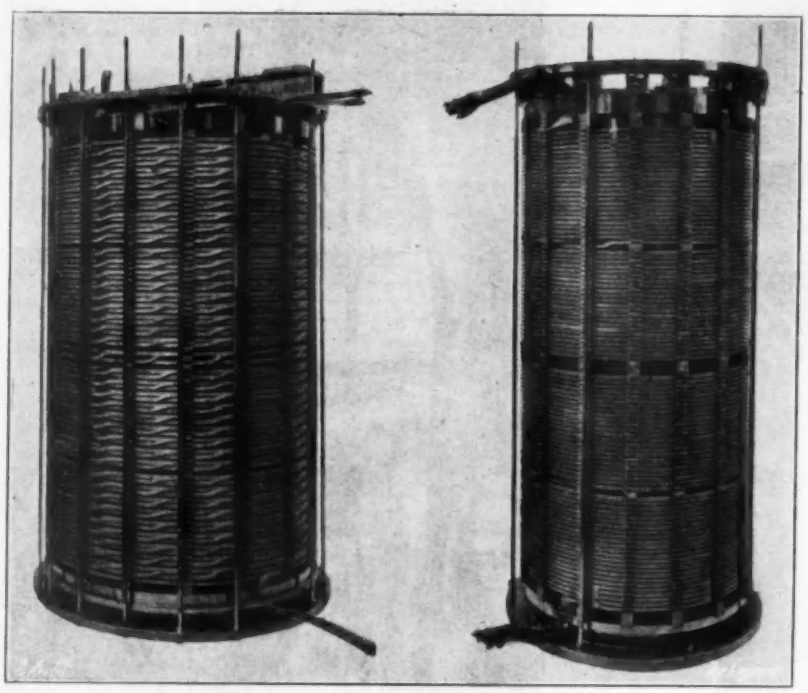


FIG. 9—HIGH-VOLTAGE SHEET INSULATION TESTING MACHINE

strength and an electrical conductivity at least equal to the remainder of the conductor and are far superior to soldered or brazed joints. When it has been suitably prepared the insulated conductor is conveyed to the winding machine, where the various sections are wound on the flat in one continuous length. Conductors are wound together in parallel as required with carefully shaped transpositions to ensure that eddy currents in the winding are reduced to a minimum. In no case are the conductors merely twisted, as the B.T.H. engineers contend that this process is liable to damage the insulation. All coils are circular, this form of coil being adopted in view of the fact that under short-circuit conditions any coil tends to assume a circular shape and the insulation of any coil that is not wound in that way is certain to be strained when such conditions arise. The coils are usually wound on cylinders of treated insulating paper, care being taken that the winding is uniformly and symmetrically carried out to reduce mechanical forces to a minimum. The coils are separated from each other and from the insulating cylinder by radial and axial spacers interlocked in such a manner as to prevent their movement relative to the windings. Coil pressure, cement, or varnish treatment are not relied upon to hold the spacers in place. The liberal oil ducts provided in the design are therefore maintained in service. Illustrations—Figs. 11 and 12—show high voltage and low voltage windings respectively.



FIGS. 11 AND 12—HIGH AND LOW VOLTAGE TRANSFORMER WINDINGS

The winding consists of a series of disc coils with oil ducts between coils, the oil being in contact with two sides of each conductor. This arrangement gives exceptionally good cooling, and, as the axial spacers are at right angles to the conductors, they give the minimum amount of blanketing. Reinforcement of the insulation on end turns is carried throughout a coil section, thus avoiding insulation joints inside a coil. The electrostatic uniformity reduces voltage concentration under stresses arising from switching transients or lightning storms in the vicinity.

When the winding is completed, it is clamped axially and subjected to a drying and shrinkage treatment The complete stack is then placed in a hot vacuum tank and the exhaust is passed through a condenser in order that any moisture may be condensed and detected. The process is continued until all traces of moisture disappear. The winding is then removed to the impregnating tank for either oil or varnish impregnation, according to the conditions of service for which it is required. If varnish treatment is needed, the winding is placed in the varnish impregnating tank, where it is again subjected to a vacuum, and, finally, a pressure of 100 lb. per square inch is applied. The coils are then removed from the impregnating tank and slowly baked in a special oven, through which there is a continuous circulation of dry air, so as to ensure complete oxidisation of the varnish, and make it impervious to the action of hot oil or moisture. At the conclusion of this process the coils are ready for assembly on the core. The processes are not worked on a time basis only. In every case there are inspections and tests so as to make certain that each desired process is completed before the next is undertaken.

All insulating material is carefully examined, tested and approved before use. Sheet insulation is passed through a high voltage testing machine and the entire surface is subjected to a test at an appropriate voltage. If puncture occurs the weak areas are cut out, or, if necessary, entire sheets or complete consignments are rejected. Spacers between coils and windings are built up from this tested material, individual thicknesses being cemented together hot in a special machine. The core laminations are composed of the best non-ageing silicon steel cut from annealed sheets, a further annealing usually being given after cutting and piercing. The laminations are then passed through a machine in which they are coated at a high temperature with a special oil-resisting varnish on both sides, this process giving a superior insulation to that of a paper covering. The laminations are assembled with interleaved joints and securely held in position between core plates by core-clamping bolts, which have been previously covered with a special asbestos insulation moulded on at a high temperature under heavy pressure in a 200-ton hydraulic press. This insulation presents a hard, smooth surface having exceptional mechanical properties and conforming to the specification for Class B insulation as defined by the International Electro-technical Commission. It has been found superior to paper tubes for core bolt insulation. After assembly all bolts are tested to the core at a pressure of 2000 volts for one minute. All structural steel is shot-blasted and cleaned before being built into the transformer, in order to remove all scale and rust.

The type of core is determined by the class of transformer. For single-phase transformers the two-legged type may be used with both legs wound, or the three-legged type with the centre leg wound. Another type is now extensively used. It has a four-part distributed return path with the centre leg wound, similar to that shown in Fig. 13. Cores for three-phase transformers are usually of the three-legged type, but when limitations of transport make a reduction in height necessary, exceptionally large units may be built with five legs in one plane. There are two general classes of winding for core type transformers. In one case, the low voltage and high voltage windings are interleaved, and in the other they are concentric. In the concentric form the low voltage winding is assembled next to the core, and the two windings are magnetically centred with respect to one another in order to reduce mechanical forces to a minimum.

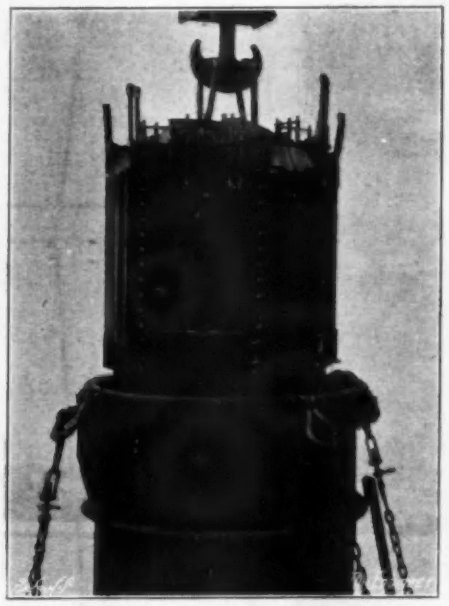


FIG. 13—TRANSFORMER WITH SPECIAL CORE

Tank construction is an important part of the manufacturing process of oil-filled transformers, and stringent tests for soundness against leakage of hot oil are always carried out. Tanks for transformers of large capacity are provided with external detachable radiators and have valves fitted in the top and bottom connections to the tank, so as to allow any of the radiators to be detached from the transformer when in service. These valves have a large and unrestricted passage in the open position. Where necessary all tanks are reinforced to reduce the risk of injury by rough handling during transit and installation. All "made joints" are provided with oil-resisting gaskets, so as to make an absolutely oil-tight joint, and all tanks are tested for oil-tightness before dispatch. After completion, transformers are subjected to complete tests for losses, temperature rise, ratio, &c., and pressure tests in accordance with the British Standard Specification No. 171.

We give, in Figs. 7 and 8, on page 575, views of the transformer test control gallery, in Fig. 9 the high voltage sheet insulation testing machine, and in Fig. 10 the machine for coating core laminations with oil-resisting varnish.

## Battersea Power Station and Sulphur.

ON Tuesday last the Ministry of Transport published an interim report on the "Treatment of Sulphur Fumes in connection with the Working of the Proposed Electric Power Station of the London Power Company at Battersea." The report was prepared by the Advisers of the London Power Company, and has been in the hands of the Electricity Commissioners since August. With it an interim report of a Committee presided over by the Government Chemist is included. The advisers of the company, who make the report, are Mr. Edward Ardern, F.I.C., of Manchester, and Mr. R. V. Wheeler, Professor of Fuel Technology in Sheffield University. They discuss, first, the conditions which are theoretically necessary for the complete absorption of sulphurous fumes by water, and then describe an experimental plant set up at the Grove-road power station, and discuss the results. The Government chemists in a short memorandum take up a cautious attitude. They consider "that there are features in the experimental apparatus and process which are still obscure, so that, while we think there is no inherent reason why similar results should not be obtained from the larger experimental plant now being erected on the lines of a projected installation at Battersea, we prefer to await the results afforded by this larger experiment."

### (1) EXPERIMENTS AT GROVE-ROAD POWER STATION, APRIL–AUGUST, 1929.

The theoretical considerations on which the proposed treatment of the flue gases for the removal of sulphur gases were based were as follows:—

From the data available, it appeared that when the Battersea power station was in commission each boiler would yield a maximum of about 170,000 cubic feet of flue gases per minute, the combustion control being such that the gases would contain 10 per cent. of carbon dioxide. The proposed lay-out of the plant arranged for three boilers to deliver to one chimney, so that about 510,000 cubic feet of flue gases would pass up each chimney per minute. This quantity of gases would be derived from 1 ton of coal per minute—burnt at the three boilers working together.

To provide a working basis, it was assumed that the flue gases from a coal containing 1·5 per cent. of sulphur would contain about 0·03 per cent. $SO_3$ and 0·05 per cent. $SO_3$ by volume, such figures having been obtained in several analyses. It was recognised that these figures might be subject to considerable variation—dependent on several factors—but they sufficed for the purposes of calculation.

*The Removal of $SO_2$.*—In small-scale experiments on the washing of flue gases with water at St. Pancras power station, 0·328 gram of $SO_2$ had been removed per litre of water, or 0·328 oz. per cubic foot, giving a sulphuric acid solution of about 0·4 per cent. This figure was taken as the basis for first calculation, though it was realised that the time of contact between the gases and the water in the St. Pancras experiments was very short and could readily be increased in practice.

Eighty ounces of $SO_2$ occupy 22·4 cubic feet; 1 cubic foot of water, according to the St. Pancras experiments, can remove—

$$\frac{0{\cdot}328 \times 22{\cdot}4}{80} = 0{\cdot}092 \text{ cubic foot of } SO_2;$$

or 1 cubic foot of $SO_2$ can be removed by 10·9 cubic feet of water.

The 510,000 cubic feet of flue gases contain 255 cubic feet of $SO_2$. Therefore, the water needed per chimney per minute, or per ton of coal burnt, would be $255 \times 10{\cdot}9 = 2775$ cubic feet $= 17{,}300$ gallons $= 77{\cdot}25$ tons.

Dependent on the time of contact between the flue gases and the water, this figure could be reduced considerably. It could, for example, readily be halved—giving a concentration of sulphuric acid of about 1 per cent. Some $SO_3$ would be removed also.

*The Removal of $SO_2$.*—At 20 deg. Cent. 1 volume of water dissolves 40 volumes of $SO_2$ at atmospheric pressure. The partial pressure of $SO_2$ in the flue gases, according to the assumed analysis, is 0·0003 atm., so that 1 volume of water would absorb 0·012 volume of $SO_2$, or 1 volume of $SO_2$ requires 83·3 volumes of water for its removal, assuming complete saturation.

The 510,000 cubic feet of flue gases contain 153 cubic feet of $SO_2$. Therefore, the water needed per chimney per minute, or per ton of coal burnt, would be $153 \times 83{\cdot}3 = 12{,}740$ cubic feet $= 79{,}400$ gallons $= 354{\cdot}5$ tons.

This amount of water would remove all the $SO_2$ also.

It will be understood that, the data available being so meagre, these calculations merely gave an indication of the character of the problem, approached as one of "gas scrubbing," the main practical consideration being, Could the chimneys, and perhaps the flues, of the proposed plant provide sufficient scrubber capacity?

Two facts were evident, having regard to the obvious desirability of reducing to a minimum the amount of water to be used:—(1) The time of contact between the flue gases and the water was all-important and required to be determined expermentally; and (2) the proportions of $SO_2$ and $SO_3$ in the flue gases required to be accurately known, for $SO_3$ can be more easily removed than $SO_2$. It was conceivable that, either by treatment of the coal on the grate or by treatment of the gases in the flues, the formation of $SO_3$ could be encouraged.

With these two main points in mind, experiments on a reasonable working scale were put in hand at Grove-road

power station. The plant used consisted essentially of a cylindrical absorption tower, 27ft. high and 40in. in diameter, with attachments for the delivery of flue gases and water in contra-flow.

The flue gases could be drawn by a fan from one of the chimney stacks—No. 2—of the Grove-road power station through a 12in. pipe delivering at the base of the absorption tower, the rate of flow being controlled by a butterfly valve at the point of entry and measured by a Pitot tube. A short exit pipe, 12in. in diameter, on the top of the tower carried the treated gases to the atmosphere. At both the inlet and the outlet pipes, draught and temperature measurements could be made and samples of the gases could be taken.

Two classes of coal, Northumberland rough smalls and Scotch washed peas, were used for the experiments. The former was of high and the latter of low sulphur content. Typical analyses, for sulphur only, are as follows :—

| Sample (May, 1929). | Pyritic sulphur. | Sulphate sulphur. | Organic sulphur. | Total. |
|---|---|---|---|---|
| Northumberland rough smalls from barge "Cydrus" | 2·63 | 0·11 | 0·90 | 3·64 |
| Northumberland rough smalls from barge "Spey" | 2·93 | 0·08 | 0·89 | 3·90 |
| Scotch washed peas. Centre bunker, No. 30 boiler | 0·72 | 0·06 | 0·45 | 1·23 |
| Scotch washed peas. Centre bunker, No. 29 boiler | 0·56 | 0·05 | 0·38 | 0·99 |

After preliminary experiments a schedule of tests was drawn up to study the effects of each factor involved systematically. It will be convenient to record the results of the more important series of tests in tabular form—see Tables I. and II.—and to discuss them later.

### I.—Tests with Cold Water.

The water entered the scrubber at 66° F. and left at 85° F. (average temperatures).

Table I.

*Series E.1 :*

*Water Flow* 1900 *Gallons per Hour.*

| | Gas velocity, ft. per sec. | Time of contact, sec. | "Acidity" of gases.* Bef're. | After. | Removal, per cent. | Water used, tons per ton of coal burnt. |
|---|---|---|---|---|---|---|
| Scotch coal | 1·9 | 14 | 1·9 | Nil | 100 | 58 |
| | 2·2 | 12 | 1·6 | Nil | 100 | 45 |
| | 2·9 | 9 | 1·6 | 0·1 | 94 | 34 |
| | 3·4 | 8 | 1·3 | 0·1 | 90 | 29 |
| | 3·6 | 7 | 1·2 | 0·3 | 78 | 28 |
| | 3·8 | 7 | 1·1 | 0·3 | 73 | 26 |
| Scotch & Northumberland coals mixed | 2·2 | 12 | 2·7 | 0·3 | 90 | 45 |
| | 3·0 | 9 | 2·5 | 0·4 | 84 | 33 |
| Northumberland coal | 1·9 | 14 | 4·9 | Nil | 100 | 58 |
| | 3·6 | 7 | 3·5 | 1·4 | 59 | 28 |

*Series E.2 :*

*Water Flow* 1100 *Gallons per Hour.*

| | | | | | | |
|---|---|---|---|---|---|---|
| Scotch coal | 1·8 | 13 | 1·7 | 0·23 | 87 | 32 |
| | 3·0 | 9 | 1·35 | 0·25 | 82 | 19 |
| Northumberland coal | 2·3 | 12 | 4·25 | 1·55 | 64 | 25 |
| | 2·9 | 9 | 4·3 | 1·1 | 74 | 20 |
| | 2·9 | 9 | 4·1 | 2·6 | 37 | 20 |
| | 3·6 | 7 | 4·5 | 2·1 | 53 | 16 |
| | 3·6 | 7 | 4·07 | 1·67 | 59 | 16 |

*Series F :*

*Water Flow* 960 *Gallons per Hour* (*Top Spray-spiral Delivering but Little Water.*)

| | | | | | | |
|---|---|---|---|---|---|---|
| Northumberland coal | 2·2 | 12 | 3·9 | 0·95 | 76 | 17 |
| | 2·3 | 11½ | 5·3 | 1·45 | 73 | 16½ |
| | 2·3 | 11½ | 4·0 | 0·4 | 90 | 16½ |
| | 3·1 | 9 | 5·4 | 0·46 | 91 | 12 |
| | 3·2 | 8½ | 5·5 | 1·4 | 75 | 12 |
| | 3·3 | 8 | 3·94 | 0·54 | 86 | 11 |
| | 3·6 | 7 | 6·0 | 1·0 | 83 | 10 |

*Water Flow* 720 *Gallons per Hour.* (*Top Spray-spiral Inactive.*)

| | | | | | | |
|---|---|---|---|---|---|---|
| Scotch coal | 2·3 | 11½ | 1·1 | 0·05 | 95 | 16½ |
| | 3·2 | 8½ | 0·9 | 0·09 | 90 | 12 |

* Expressed as milligrams of $H_2SO_4$ per litre of gases.

From these and similar series of experiments, it can be concluded that, when the time of contact of the flue gases with the wash-water is over 12 sec., there is complete removal of the sulphur gases, even when their original concentration is high, if sufficient water is used. As the velocity of the flue gases increases, the efficiency of removal of the sulphur gases decreases, but it is still high (90 per cent.) with times of contact as low as 7 seconds.

Comparative experiments (details not here recorded) with the absorption tower (1) empty save for the spray-spirals and (2) packed, as to its upper portion, with absorption rings, showed that the efficiency of removal of the sulphur gases was as good with the unpacked as with the packed tower, provided that sufficient water was used. Rather more water was required with the unpacked tower.

### II.—Tests with Hot Water.

It had to be borne in mind that the temperature of the gases leaving the scrubber must not be too low, lest there should be objectionable condensation of moisture, and downward flow, when they met the air. Any downward flow might be avoided by delivering hot air near the top of the chimney stack to mingle with the flue gases after they were washed. The use of hot water might be equally effective.

In the experiments with hot water, Table II., the temperature of the water used averaged about 145 deg. Fah. The temperature of the gases entering the tower averaged about 190 deg. Fah. and their temperature on leaving was about 140 deg. Fah.

Table II.

*Series H, H.1 and H.2 :*

*Water Flow* 720 *Gallons per Hour.*

| | Gas velocity, ft. per sec. | Time of contact, sec. | "Acidity" of gases. Bef're. | After. | Removal, per cent. | Water used, tons per ton of coal burnt. |
|---|---|---|---|---|---|---|
| Scotch coal | 1·8 | 15 | 1·16 | 0·05 | 96 | 21 |
| | 1·9 | 14 | 0·74 | 0·07 | 91 | 20 |
| | 1·9* | 14 | 1·50 | 0·42 | 72 | 20 |
| | 2·1 | 13 | 1·12 | 0·08 | 93 | 18 |
| | 2·2 | 12 | 1·63 | 0·07 | 96 | 17 |
| | 2·4 | 11 | 1·22 | 0·09 | 93 | 16 |
| | 2·8 | 9½ | 1·28 | 0·09 | 93 | 13½ |
| | 2·8 | 9½ | 0·91 | 0·18 | 80 | 13½ |
| | 3·1 | 9 | 1·06 | 0·09 | 91 | 12 |
| | 3·4 | 8 | 0·57 | 0·09 | 84 | 11 |
| | 3·5 | 7½ | 0·67 | 0·13 | 81 | 11 |
| | 3·6 | 7 | 1·23 | 0·13 | 89 | 10½ |
| Scotch & Northumberland coals mixed | 2·0* | 13½ | 2·16 | 0·95 | 56 | 19 |
| | 2·0* | 13½ | 1·89 | 0·60 | 68 | 19 |
| | 3·1* | 9 | 1·91 | 0·49 | 74 | 12 |
| Northumberland coal | 2·2 | 12 | 4·58 | 0·65 | 86 | 17 |
| | 2·9 | 9 | 5·06 | 0·52 | 90 | 13 |
| | 3·7 | 7 | 5·19 | 0·71 | 86 | 10 |

* It is suspected that in these tests the packing rings in the upper part of the tower had become dry.

Further series of tests, using different quantities of water, confirmed these results. The use of excess of water (quantities up to 65 tons per ton of coal burnt were tried) was not advantageous, whilst a series of tests when the low-sulphur coal was being burnt showed that as little as 6 tons of water per ton of coal burnt could effect a 90 per cent. removal of the sulphur gases (gas velocity 3·2ft. per second).

A striking feature of these tests with hot water was the absence of any smell of $SO_2$ in the wash-water. When using cold water, this smell was always noticeable and analysis showed the wash-water to contain sulphites. On analysing the hot wash-water, it was found that sulphites and thiosulphates were entirely absent. All but about 2 or 3 per cent. of the total sulphur they contained could be accounted for as sulphate.

It thus appears that, by the use of hot water, the desired transformation of the $SO_2$ of the flue gases into $SO_3$ has been effected. The efficiency of removal of the sulphur gases by comparatively small quantities of hot water is thus explained. The manner in which the transformation from $SO_2$ to $SO_3$ is effected, whether by the catalytic action of dust in the flue-gases or by the formation of ozone or hydrogen peroxide during the evaporation of the hot water, is still the subject of experiment.

All the experiments have been conducted by Mr. G. W. Hewson, chief chemist of the London Power Company We have been impressed by his accuracy of observation and close attention to detail.

### (2) Practical Application of Experiments.

It having been found that the amount of water required effectively to remove the sulphur gases from flue gases, even when their concentration is high, is not excessive, a scheme for the treatment of the gases at the Battersea power station was drawn up.

[The plant comprises a tower some 150ft. high, in which the flue gases make a double pass—down and then up—before entering the chimney, the top of which is 300ft. above ground level. In the tower the gases are scrubbed. A long line of grit catchers is also provided.]

It more than fulfils the requirements—as regards, for example, the time of contact of the flue gases with the wash-water—indicated by the Grove-road experiments, and allows for an additional treatment, a final washing with a slightly alkaline solution, which we do not consider will be necessary. Provision has been made for the insertion of packing material—rough-sawn boards on edge—both in the downtakes from the main flue and in the uptakes to the chimney stacks. The Grove-road experiments indicate that but little packing material will be required, the sprays in the main flue alone, with perhaps some packing in the downtakes, being sufficiently effective. To guard against the emission from the chimney stacks of gases saturated with water vapour, with consequent condensation in cold weather, arrangements are provided for delivering hot and dry air to the stacks, either just above the "eliminator plates"—which will trap entrained moisture—or at any point higher up the stacks.

As regards the neutralisation of the wash water, this will be effected by mingling with the "condenser" water, the volume of which will be about forty times that of the wash water.

The only alteration in the character of the river water would be a slight diminution in the carbonate content and a corresponding increase in the amount of sulphate present. Should the necessity arise for further treatment, for example, to remove suspended matter or to oxidise any sulphites that may occasionally be present, provision is made for settling tanks of adequate capacity.

### Chemists' Report.

The following passage is taken from the interim report of the Committee presided over by the Government Chemist :—

From what we have seen of the process in its small experimental stage, while we consider that it has afforded results that are promising, we consider that there are features in the experimental apparatus and process which are still obscure, so that, while we think there is no inherent reason why similar results should not be obtained from the larger experimental plant now being erected on the lines of a projected installation at Battersea, we prefer to await the results afforded by this larger experiment. We think it necessary that a more definite explanation of the mechanism of the oxidation of sulphurous to sulphuric acid in the experimental process should be forthcoming before we can report on the practicability of the process.

In connection with this power station, very large quantities of condenser water are to be used, as much as 500 tons, we were informed, for every ton of coal burned. A portion only of this quantity should be required for washing the gases. We have ascertained that the alkalinity of Thames tidal water near Battersea is about 20 parts per 100,000. Five hundred tons of such water would have twice as much alkalinity as is necessary to neutralise the sulphur acids derived from 1 ton of coal containing 1·5 per cent. of total sulphur, even assuming that no sulphur remains in the clinker. Under these conditions, there is no chance of an acid effluent going into the river if all the condenser water is systematically utilised for neutralisation, and this condenser water before being withdrawn maintains the required alkalinity, but there is a chance of some calcium sulphite remaining in solution. This, although a neutral salt, might be objected to on account of its property of further depleting the river of oxygen. From the ready oxidisability of sulphurous acid and sulphites, their total conversion into sulphuric acid and sulphates should be easy, in which case the effluent water at Battersea would still retain a certain alkalinity, and would be altered only in the sense of having in solution a small quantity of innocuous calcium sulphate.

We understand that mechanical separators are to be used for eliminating the bulk of the dust. The washing process which the gases undergo for removal of sulphur acids should prevent the escape of most of the residual dust particles, but we have no experimental data on this aspect of the question.

This report is signed by R. Robertson (Chairman), C. H. Lander, J. Macintyre, and T. Lewis Bailey.

## Perran Foundry.

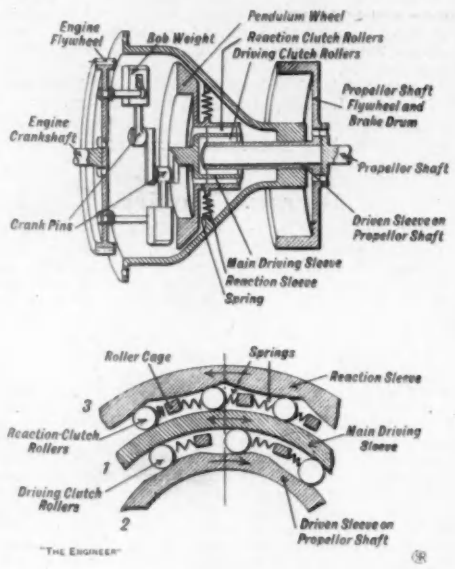
The important part played by Perran Foundry in the pioneer century from 1750 to 1850, when Cornwall was one of the principal centres of mining and engineering activity in the world, is the subject of an interesting and informative article in the 96th annual report of the Royal Cornwall Polytechnic Society, issued recently. The author, Mr. W. Tregoning Hooper, says that in the early nineteenth century the mechanics from Perran often submitted models, inventions or proposed improvements in the construction and methods of manufacture of steam engines to Mr. Robert Were Fox, of Falmouth, for his opinion. "The ingenuity and keenness of these men so impressed Miss Anna Maria Fox that she proposed that a society should be formed to encourage and assist such men to study the sciences connected with their work. Miss Fox's suggestion was well supported by her father (Mr. R. W. Fox) and members of the family, and the result was, with the assistance of Sir Charles Lemon and many others, the formation of the Cornwall Polytechnic Society, which a few years later received Royal patronage and its present title. It will be seen, therefore, that this society may not unfairly be said to owe its origin to Perran Foundry." Mr. Hooper goes on to say that the great improvements by Messrs. Boulton and Watt in the steam engine made it possible to develop the Cornish mines on a larger and deeper scale, and in 1791 the Fox firm decided to establish a foundry capable of supplying all the machinery required by Gwennap mines, the site chosen being in the beautiful vale of Perranarworthal, at the head of a branch of Falmouth Harbour. "Davies Gilbert, writing in 1835, refers to Perran Foundry as being the first of any magnitude in the country, and that cylinders of 90in. diameter were cast and bored with the utmost degree of accuracy. In 1815, a large beam was cast for Trevithick's famous 76in. pumping engine, which was erected at Dolcoath by the engineers Jefferies and Gribble. The beam in question weighed from 25 to 30 tons. This engine was the first high duty single-cylinder engine erected in the county and gave a duty of 40,000,000, being double the duty on the Watt engine which it replaced. It continued to work until 1867, when it was replaced by a new engine; but the old beam was again utilised and remained in use until recently. This beam and engine are referred to in Burrow's *Mongst Mines and Miners* as one of the objects which remind one of the remarkable antiquity of Dolcoath mine." The author of the article goes on to say that the foundry enjoyed a world-wide reputation for the excellence of its products, which consisted mainly of mining machinery, and among the principal engines made there he mentions Taylor's 85in. for the United Mines (1840); Haarlem Lake, Holland, 144in. and 84in.; Harris Navigation Colliery, 100in., and 144in. blowing engine for Ebbw Vale Steel Works; Wheal Busy, 90in., and four large engines for the Burra Burra mines. He also mentions that the steel or ironwork for the Lizard Lights building was all prepared at Perran Foundry and erected by the firm. The foundry could likewise claim an early acquaintance with the marine engine, as it was reported in a newspaper dated April 5th, 1832, that the "Firebrand" steam packet was to proceed to Malta that day after having been repaired by workmen of Messrs. Fox and Co., of Perranwharf; but little marine work was undertaken until 1866. Four or five steamers were then engined for Captain Philip Thomas, of Falmouth, among them being two well-known vessels, the "Prairie Bird" and the "Rapide," while several yachts and a very fast launch for the Thames Water Police were engined. The manufacture of mining implements was also an important part of the work done at the foundry, especially shovels. The demand for shovels necessitated night shifts being worked for long periods in order that shovel-making could proceed without interfering with the foundry's normal activities. Wide as the firm's reputation was, says Mr. Hooper, its great mainstay was the Cornish mines, and when the Gwennap mines ceased work it soon became obvious that Perran would also have to cease operations. The end was hastened by the death of Mr. Shilson and the failure of Tweedy's Bank. In 1879 the works were closed, the machinery sold or broken up, and a company of efficient workmen was scattered all over England to enrich younger concerns with their skill and experience.

---

The Lancashire County Council has given public notice of the intention to deposit a Bill for the creation of a Lancashire Traffic Board, as recommended in the second report of the Royal Commission on Transport.

## The Spontan Transmission Gear for Motor Vehicles.

THE ordinary mechanism for the control of a motor car leaves much to be desired in the matter of simplicity. Apart from steering, the driver has two pedals to operate, and must make frequent recourse to a change-speed lever, the manipulation of which has to be skilfully performed in conjunction with the pedal movements. Many inventors have tried to improve upon the standard gear-box, either by providing for automatic gear changing or by substituting some other device for the mechanically crude "crash gears," which only the experience of drivers and the quality of materials have rendered tolerable. Such efforts, however, have made little




FIGS. 1 AND 2

impression on motor car practice, probably because even the best of them only offered a very partial solution to the general problem of simplifying the control of the vehicle. This problem attracted the attention of Mr. Fredrik Ljungström, whose name is familiar as the designer of the most successful turbine locomotive, and for some years past he has been occupied with the development of mechanism to reduce the driving of a motor car to its simplest possible terms. As might be expected, his solution has been a radical one. Except for the steering wheel and the emergency hand brake required by law, the driver has nothing to attend to but a single pedal. By the mere depression of this pedal, which has no sideways, or other unusual movements to perform, the brakes are released, the clutch engaged, the engine accelerated, and the gear ratio changed automatically. Speed is controlled simply by the pressure on the pedal. On the release of the latter, the operations mentioned are performed in reverse order, and the car is brought to rest with the brakes on. Raising the pedal from its neutral position puts the car in reverse gear. Depressing it now causes the vehicle to start backwards. To get into forward gear again, the pedal is once more raised above the neutral position, and when next depressed the car starts forward. There is, moreover, nothing delicate about the operation of the pedal. It may be depressed slowly or suddenly, for the nature of the mechanism prevents the engine being stopped inadvertently by overloading it at low speeds. The car also coasts of itself, free-wheeling, with the engine idling, when the road conditions permit.

The apparatus by which these results are obtained is known as the Spontan gear, the name being derived from the word "spontaneous," and having reference to the automatic properties of the gear. The mechanism is enclosed in a casing forming an extension bolted on to the crank case of the motor, and little is to be seen externally but the single pedal. Inside the casing however, is an arrangement of the greatest interest to all who can appreciate ingenuity applied to the solution of difficult mechanical problems. The main feature of the Spontan gear is the peculiar nature of the connection between the fly-wheel of the engine and the propeller shaft of the car. The end of the propeller shaft is embraced by a driving sleeve which transmits power to the shaft by means of a roller clutch between the two. The driving sleeve carries two excentrics fixed at 180 deg. from each other. Each excentric is surrounded by a strap carrying a heavy bob-weight, and these bob-weights are connected to the fly-wheel by means of links. The arrangement is shown diagrammatically in Fig. 1, in which, for the sake of greater clearness, the excentrics have been replaced by the crank pins to which they are mechanically equivalent. It will be evident that if the propeller shaft is held stationary by the resistance of the car to motion, the driving sleeve will be also motionless, and the rotation of the fly-wheel will cause the bob-weights to be swung around their respective crank pins at the same speed as the engine turns. As they rotate, their unbalanced centrifugal force tends to turn the driving sleeve first in one direction and then in the other. The motion in one direction is resisted by the difficulty of moving the propeller shaft, and in the other by the inertia of the heavy "pendulum wheel" attached to the casing by springs and acted on by the driving sleeve by means of another roller clutch. The two-roller clutches are arranged concentrically with each other, and drive in opposite directions, as will be understood from Fig. 2.

The rotational impulses given to the propeller shaft and to the pendulum wheel by the centrifugal force of the bob-weights increase in intensity as the square of the engine speed, until those acting on the propeller shaft become powerful enough to move the car forward. The reverse impulses are absorbed by the pendulum wheel, the reaction of the springs by which the latter is held restoring the energy to assist the forward motion of the car. After the car has begun to move the forward impulses of the bob-weights act on the driving sleeve for progressively longer periods because the crank pins begin to follow the bob-weights round. Equally, of course, the negative impulses last for shorter and shorter times. Finally, when the driving sleeve and propeller shaft attain the engine speed, the impulses on the pendulum wheel vanish, and those on the propeller shaft are smoothed out into a perfectly even torque. Under these conditions, the bob-weights, links, excentrics, and driving sleeve, all move round together as a solid body, with no relative motion of the parts, and the engine is virtually coupled fast to the propeller shaft. The car is then on "direct drive."

Suppose, now, that the resistance to the motion of the car increases, as, for example, on a rising gradient. The first effect is to cause the driving sleeve to lag behind the engine fly-wheel, thus increasing the leverage of the centrifugal forces of the bob-weights until the torque is increased sufficiently to overcome the added resistance. So long as this adjustment is enough to meet the conditions, direct drive is maintained. Should, however, the resistance of the car be too great to be taken care of in this fashion, the bob-weights will commence to revolve on their excentrics. The drive then becomes indirect, with a speed ratio automatically adjusting itself to the power of the engine and the resistance of the car. When the car gets on the level again, the drive changes over automatically from indirect to direct, the driver having had nothing to do all the time but regulate the power of the engine, if he desires to, by varying the pressure on his pedal.

Having given this general description of the principle of the Spontan gear, we may now turn to the actual mechanism, in which it is embodied. Fig. 5 shows the gear attached to an ordinary motor car engine, the pedal by which the car is controlled being very evident in the engraving. It may be remarked that the drum-shaped piece, seen on the right, is not a gear wheel, but is the propeller shaft fly-wheel, with helical cooling ribs to dissipate the heat from a brake inside it. Longitudinal and cross sections through the gear-box are given in Fig. 3. Referring to these illustrations, it will be seen that the engine fly-wheel is made in two parts *a* and *b*. The part *a* is of light construction and serves for little more than to carry the toothed rim for the connection to the ordinary starting motor. The engine torque is carried by the central shaft *c* to the rear end of the gear-box, and then back again through the hollow shaft *d* to the part *b* of the fly-wheel. This is

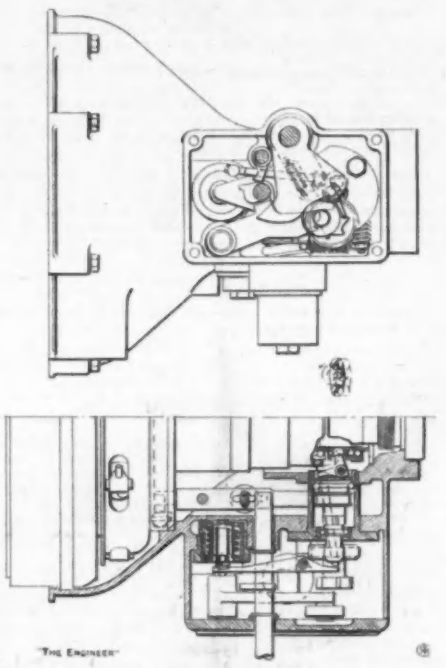



FIG. 4—REVERSING GEAR

the heavy part of the fly-wheel, and serves to transmit the torque to the gear. It will be seen that the arrangement provides a certain angular flexibility between the engine and the transmission, while a damping device between the rims of the two parts of the fly-wheel smooths down any torsional oscillations which might develop.

The face of the fly-wheel disc *b* is provided with two studs *e e*, each of which carries a link connecting it to one of the bob-weights *f* and *g*. Each weight rides on a pair of excentrics by means of ball bearings, the excentrics, marked *h* and *j* being rigidly fastened to the main driving sleeve *k*. Fig. 7A is from a photograph of the inner fly-wheel disc *b*, with links, bob-weights, and driving sleeve assembled. The projecting central shaft is that already mentioned as forming part of the flexible connection between the two parts of the fly-wheel. Inside the driving sleeve is a roller cage containing two sets of rollers, forming the inner clutch which drives the car. The inner sleeve *l*, on which the rollers act, is connected to the propeller shaft, and carries the fly-wheel, prominent in Fig. 5, which acts also as a brake drum for the transmission brake. The assembly of the propeller shaft and fly-wheel, with the driving cage in position, is shown in Fig. 7F.

On the outer circumference of the driving sleeve is another roller clutch, acting in the opposite sense upon the reaction sleeve *m*. This reaction sleeve carries the pendulum wheel *n*, and is connected to the casing by the six helical tension springs shown clearly

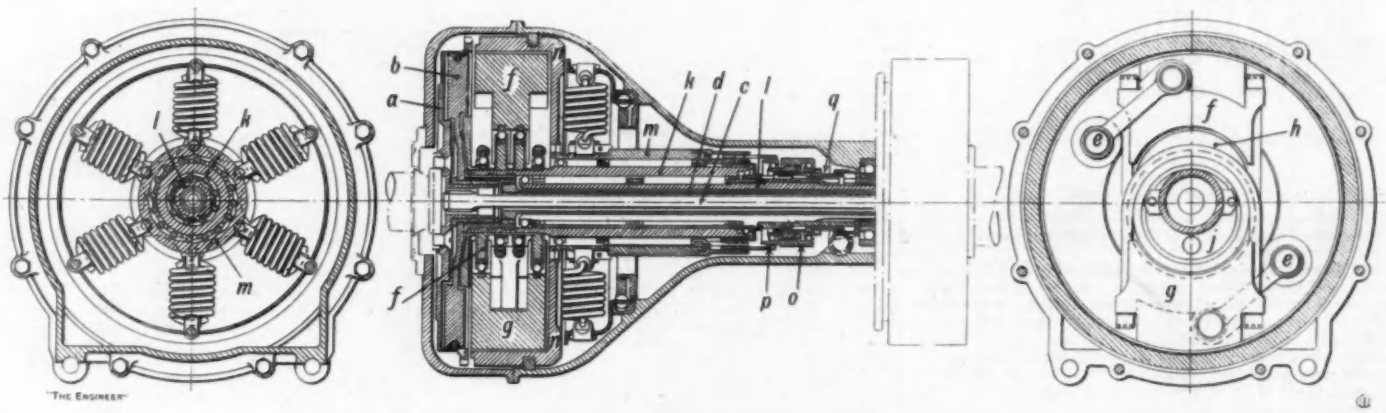



FIG. 3—SECTIONS THROUGH SPONTAN GEAR-BOX

in the illustrations. As can be seen in Fig. 3, and more clearly in the diagrammatic sketch, Fig. 2, the rollers of each clutch work between two opposed inclined surfaces. Reversing can therefore be effected by turning the roller cages in relation to the sleeves, thereby bringing the rollers into contact with the opposite set of surfaces. The means adopted for turning the cages will be understood from Fig. 7 B. When the driver wants to reverse, he lifts the pedal slightly from its normal "brake-on" position by means of the toe strap seen in Fig. 5. In raising the pedal he causes a spring-loaded pawl to engage with the ratchet wheel seen in the lower part of the engraving, Fig. 7 B. When the pedal is again depressed, this ratchet wheel is caused to make one-sixth of a turn, which, by means of the two spur wheels shown, is transformed into half a turn of the reversing spindle. This spindle carries a crank pin at the other end, which engages with the ring *o* in Fig. 3, and causes the reversing sleeves *p* and *q* to move longitudinally. The reversing gear is shown independently in Fig. 7 E, and the outer cage with the sleeve which operates it, in Fig. 7 D. Helical slots in the reversing sleeves cause the longitudinal motion of the latter to give a partial rotation in opposite directions to the roller cages, thus bringing about the engagement of the rollers with the opposite inclined surfaces of the driving and reaction sleeves.

To ensure the gripping action of the rollers they are kept up to their work by means of springs. When the car is running normally on direct drive, the outer clutch is "free-wheeling." Road experience showed that during these long free-wheeling periods a certain amount of wear of this clutch took place, so to avoid this, provision is now made to relieve the pressure on the rollers. The roller pressure is now dependent on the pressure of the lubricating oil, being automatically relieved as the viscosity of the oil is reduced by the rise of its temperature. The oil pressure acts on the piston shows in Fig. 7 B, the motion of this piston being transmitted by the lever shown to a mechanism which alters the radius at which the reversing crank pin works. Thus the degree of rotation of the clutch sleeve is modified, so that the pressure on the rollers is reduced, as the oil pressure becomes lower. Details of the reversing and clutch-relieving mechanism are given in Fig. 4. We understand that the automatic relief of the roller pressure has been entirely successful in avoiding wear of the clutch, no wear whatever being detectable after long periods of service.

Under ordinary circumstances the pendulum wheel *n*, in Fig. 3, is anchored to the gear casing. This is effected by a split ring, which is normally expanded against the row of surrounding balls, thus locking their cage. The cage is extended sideways to form an anchorage for the outer ends of the pendulum wheel springs. During the act of reversing, the balls are momentarily released, thus giving the pendulum wheel and the outer clutch sleeve complete freedom. The object of this is to relieve the clutch rollers from any strain which might make it difficult to turn the roller cages.

As has already been mentioned, the first part of the downward movement of the pedal releases the brake, and when the brake is entirely off a continuation of the pedal movement opens the engine throttle, the change in gear ratio between the engine and the road wheels taking place automatically and uniformly as the engine speeds up. Since the driving clutch "free-wheels" when the propeller shaft tends to rotate faster than the engine, the latter cannot be used as a means of braking the car. The braking system provided has therefore to be capable of much harder and longer continued work than that of an ordinary car. Ordinary retardation and stopping is carried out by means of an expanding brake working inside the drum shown on the propeller shaft in Fig. 7 F. The brake itself in its relation to the pedal is shown in Fig. 7 C. The drum is efficiently air cooled by the helical fins on its circumference. The brake shoes within it have a certain floating freedom, so that there are no unbalanced forces on the shaft or the drum, and the braking effect is always smooth and proportional to the position of the controlling pedal. Should, however, the latter be in the "brakes full on" position, and further braking force be called for, as during the descent of an exceptionally steep incline, it is fur-

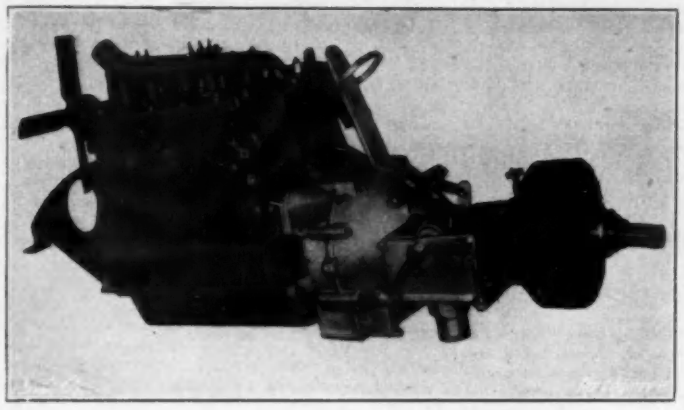


FIG. 5—ENGINE FITTED WITH SPONTAN GEAR

FIG. 6—CAR FITTED WITH SPONTAN GEAR

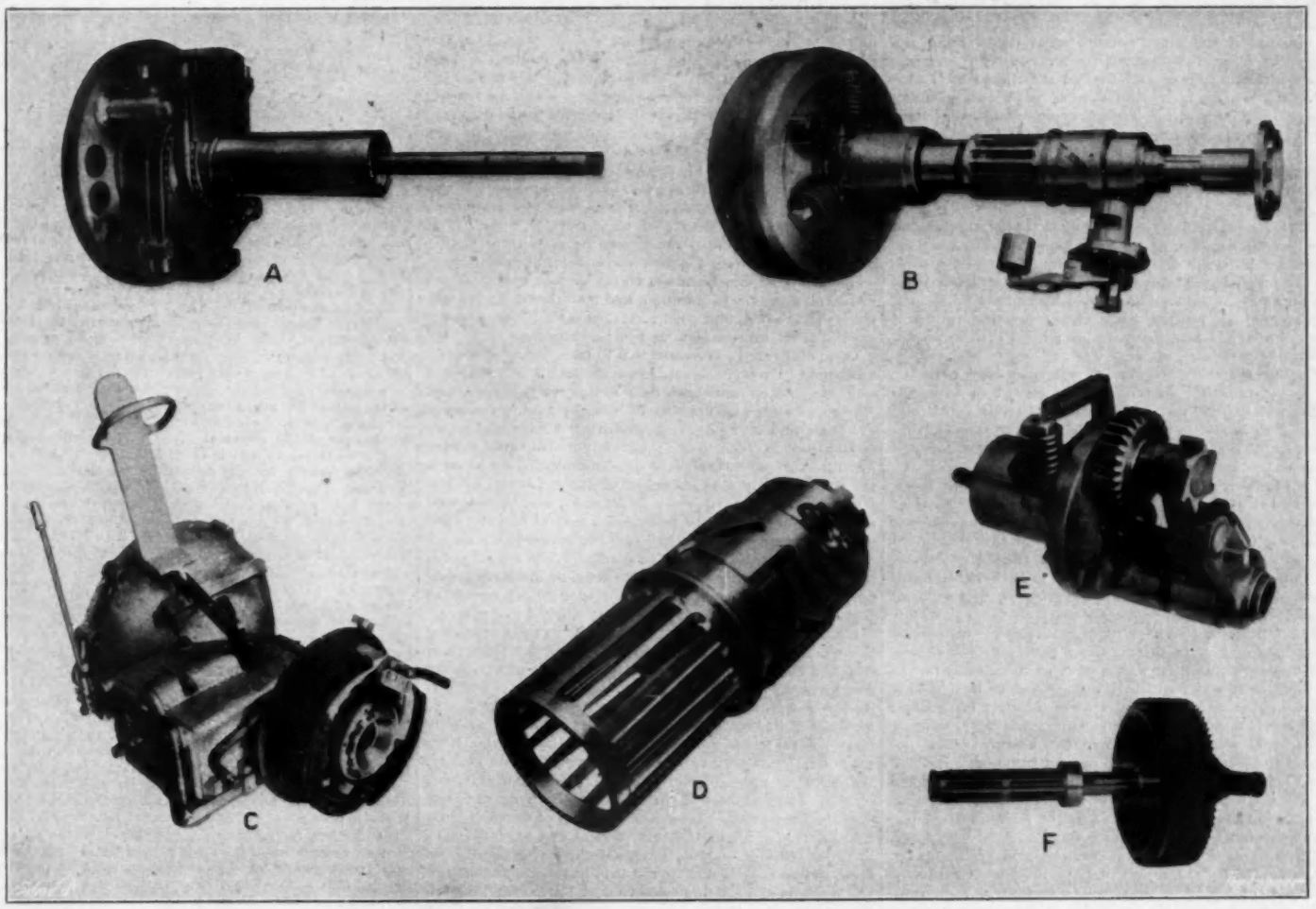



FIG. 7—DETAILS OF THE SPONTAN MOTOR CAR TRANSMISSION GEAR

nished automatically by front-wheel brakes, which are brought into action by the increased drag on the brake shoes in the drum. There are, in addition, ordinary hand-operated brakes acting on the rear wheels.

The simplicity of driving a car fitted with the Spontan gear will be gathered from Fig. 6. The driver has, in addition to his steering wheel, nothing but a pedal for his right foot and an emergency brake, of which the handle lies under the instrument board, convenient to his right hand. The entrance to the seats is not encumbered by levers or other obstructions of any kind. There are now several cars on the roads of Sweden equipped with the gear in question, and experience of its use extends over two years or more. A striking testimony, both to its durability and reliability, is to be found in the fact that it has now been in service for many months on a taxi-cab in the streets of Stockholm, where it has proved itself capable of withstanding driving conditions about as severe as can fall to the lot of any motor vehicle. The gear is constructed by the Aktiebolaget Spontan, of Stockholm 7, Sweden.

## Letters to the Editor.

*(We do not hold ourselves responsible for the opinions of our correspondents.)*

### THE TAXATION OF INDUSTRY.

SIR,—If the leading article in your last issue has the effect of inducing a larger proportion of responsible men in the engineering industry to take a look outside the office window and works door for the main causes of the troubles with which they are struggling so manfully within, you will have rendered a valuable service, not only to the industry itself, but to the country as a whole. Their well-trained and practical minds need only be directed to some of the bigger aspects of national economics, and their bearing on productive industry, to excite their keen interest and stimulate them into action. When they do concentrate on the conditions and problems which will then come under their observation, they will soon see into the middle of them, and, incidentally, will expode the fiction that economics, finance, and fiscal policies are quite beyond their comprehension. They will discover that many of the most potent forces determining the success or failure of their efforts are remote from their own works and offices, and beyond their individual control. Sooner or later—unfortunately in this country it is so often later or too late—they will realise that their only chance of exercising any control over these external forces lies in highly developed organisation, whereby the engineering industry may become a power in the land instead of the impotent victim of fortuitous circumstances.

Of these external forces, the burden of national and local taxation is one, and a very important one. Others that may be cited as examples offhand are :—Britain's part in international finance, our banking system, credit and currency, price levels, tariffs, commercial treaties, the development of Empire trade, transportation problems and costs, the mal-adjustment of wages, education and training of *personnel*, research work.

For the moment, however, I will deal only with the burden of taxation on industry, in regard to which so many widely different and even conflicting views and arguments have been propounded by reputed authorities, that the plain man despairs of discovering the truth of the matter.

Lord Colwyn's Committee on National Debt and Taxation issued their report in November, 1926, and their investigations extended to the financial year 1925–26, when the total amount of direct and indirect taxation was no less than £665 millions, or £14 14s. 5d. per head, as compared with £3 11s. 4d. per head in 1913–1914. Local taxation did not come within the purview of the Committee.

The Committee arrived at the surprising conclusion that, except for its discouraging psychological effects, this burden of taxation was neither as formidable nor as crushing as it was frequently represented to be ; that it did not enter appreciably into prices or affect the general price level, and that, even in conjunction with the loss of material wealth due to war expenditure which lies behind the National Debt, the present taxation is not one of the main causes of industrial difficulty. In fact, when reading the report one is almost bemused into feeling that taxation on an ascending scale might miraculously open a way through our troubles into Wonderland.

The Balfour Committee on Industry and Trade, on the other hand, with the report of Lord Colwyn's Committee before them, came to the conclusion that a high rate, even of direct taxation, has very serious effects on competitive power, both by diminishing the fund out of which the bulk of the national savings is accumulated and extensions and improvement of industrial plant are provided, and also by discouraging enterprise and initiative.

For the consideration of those who may be in doubt as to the extent to which taxation is a burden on industry, I venture to submit the following facts and figures.

According to the best available estimates, the national income in 1924 was £4164 millions, of which about £2000 millions were contributed by productive industry.

The 1921 census of population showed that approximately 50 per cent. of the people were engaged in production, repair and maintenance work.

In the light of these two significant figures, it is clear that industry bears at least one-half of the burden of direct and indirect taxation, and it is fair to assume that it bears a no less proportion of local taxation.

The estimated national taxation for the financial year 1929–30 is £666·86 millions. If to this be added £180 millions for local taxation, we reach the huge total of £846·86 millions, of which industry will bear at least one-half, or £423 millions, which is no less than 21·1 per cent. of industry's estimated contribution to the national income.

We know that, in fact, industry pays more than one-half share of the taxation, though it is impossible to show how much more. Property owners, bankers, merchants, traders, and professional men are able to and do pass on a larger or smaller share of their taxation, but unsheltered industry exposed to foreign competition is unable to do so to anything like the same extent.

I, for one, refuse to believe that our huge burden of taxation is not reflected in our costs of production and our price level, or that it is not a serious handicap on our export trade.

D. A. BREMNER.
Director—British Engineers' Association.
London, S.W. 1, November 26th.

### CANAL TRANSPORT.

SIR,—A letter in THE ENGINEER by Captain G. C. C. Henderson on canals is so typical of what is being said and written about transport problems by canal advocates who fail to see some of the cardinal points involved, that it deserves something like detailed criticism. Transport cost is second only to productive cost in the problem of trade. Many people think that our rail rates are extravagant, and that transport might be greatly cheapened by deeper and wider canals. Let us see.

Mr. Henderson invites us to believe that modern barges can carry goods at about one-quarter the rates charged by rail. This theory can be put to the test at once. On the Aire and Calder Navigation in Yorkshire we have the most modern coal-carrying barges in the world, and we have such favourable natural conditions as are not to be found generally in Great Britain. From a point near Leeds, Wakefield and Barnsley to Goole, the ground is much more level than in most parts of this country ; the canal is excellently constructed ; it is assisted by the natural rivers Aire and Calder ; it is equipped with such loading and discharging machinery as is not to be found elsewhere in the world ; big "compartments" are loaded at the pits, conveyed in carriages to the canal, hauled in long trains by tugs, and the "compartments" are pulled up and emptied at Goole, the coal shot into sea-going vessels, by wonderful hoists, operated rapidly and economically. The Aire and Calder Navigation and its equipment and methods have to be seen to be believed. They are the latest word in efficiency. Furthermore, from Goole to Hull there is tidewater—natural river, natural navigation which has cost nothing to make. In spite of these points, so extremely favourable to coal transport by water, Hull receives thirty times as much coal by railway as by the navigation. This fact destroys the theory that inland water transport is or can be made cheap in this country. In nearly all other parts of mining and manufacturing Britain the levels are bad, and good rivers, suitable for economical canalisation, are conspicuous by their absence.

One point canal advocates seem to miss is that of accommodation. Even if the canal rate is much lower than the rail rate, the circumstance does not prove real economy. Railways, with their network of branches and spurs, serve every pit and every dock, nearly every village and group of factories, in the country ; but no possible canal system can directly or conveniently or economically serve more than a relatively small number of our industrial plants, our coal areas, our villages or farms and ports. Most goods carried by canal have to be handled several times. They have to be transported by rail or other means to the canal, and by rail or other means to market. The actual canal rate constitutes only a part of the total or inclusive transport charge. If canals had been economical means of transport, they would not have been allowed to decline.

Mr. Henderson describes canals as our "one sure avenue to economic salvation." He might as well say that ocean shipping is the one sure avenue to economic salvation for Switzerland. Just as it is physically impossible for Switzerland to be a great ocean shipping country, so is it impossible for Britain to be a great canal country. Canals can only be successful where the ground is nearly flat and the rivers are good. Nearly every part of industrial Britain is hilly. We have an average rise or fall of more than 10ft. per mile of canal. In continental Europe the average is not even 1ft. per mile. Through large parts of Germany and France, Holland and Belgium, barges can travel dozens of miles without encountering a lock, the ground is so level. Here the conditions are totally different. Between Birmingham and London we have over 150 locks ; between Berlin and Hamburg, a longer distance, there are only three locks. Canal construction or re-construction is extremely costly with us. From the evidence submitted to the Royal Commission on Canals, it is clear that merely to improve our existing waterways to accommodate 100-ton barges would cost five times more than it has cost to make canals for 500-ton boats on the Continent.

And there are other difficulties in our way. With our canals widened and deepened, and made to deal with more and bigger barges, with the consequent bigger and more frequent losses of water downward by the lockages, the supply of adequate water for the top reaches would be an almost impossible—certainly an extremely expensive—engineering proposition. Again, no matter how we improved our canals or how well we managed to deal with the water problem for the top levels, our barges could not operate so well, so quickly, or so economically as the barges on the foreign canals, because of the enormous number of locks per 100 miles of navigation. Then, again, we should have great delays and difficulties in frosty weather. Last winter continental canals were ice-blocked many weeks, and to-day they are short of water and barges cannot be fully loaded, because of the effects of the dry summer. Canal rates have advanced abnormally in the last few weeks in France and other continental countries, and there is much inconvenience. To put it shortly, the railway in hilly Britain as effectively beats the canal as the oil lamp beats the tallow candle and as the gas lamp has beaten the oil lamp. Canalisation offers no sort or kind of avenue to our economic salvation, for only in small and selected and highly favourable areas can a waterway be even moderately successful, and even in such areas a canal can only serve a small minority of traders. To spend tens of millions of money on canalisation in this country would be an act of madness. I am an old canal boatman ; I know the conditions ; and I say that no possible or conceivable canal system could handle 20 per cent. of our traffic with satisfaction.

E. T. GOOD.

Sheffield, November 23rd.

SIR,—There is one aspect of canal development which I hope will not be lost sight of, viz., floating electric power stations—oil driven—of moderate power, which can be anchored anywhere and distribute very economically to the district around.

These are at work in Germany and are specially useful in areas remote from the land lines of power stations.

FRANK NOAKE.

Birmingham, November 23rd.

### SCIENCE AND LEGISLATION.

SIR,—May I point out that now there is a Science Committee in the House of Commons and that an attempt is being made to induce those in authority in the Dominions and the Australian Commonwealth to set up similar committees there in their Houses of Assembly ? It is hoped in time that such committees may work together and help in every possible way to develop the Empire on the lines of greatest efficiency from the point of view of science.

W. P. DREAPER, O.B.E., F.I.C.
Hampstead Heath, N.W. 3, November 24th.

## SIXTY YEARS AGO.

IT is well known that what we call the Stephenson link motion ought more correctly to be referred to as the Howe motion. In our issue of November 26th, 1869, some notes were given on the history of the invention. Howe, a mechanic in the employment of Robert Stephenson and Co., introduced his link motion in August, 1842. It was based on a suggestion made by a young gentleman apprentice, Mr. Williams, who showed his drawing to Howe and several others. Mr. Williams proposed to employ two side-by-side excentrics at 180 deg. The straps were to be provided with a short lug each, and the two lugs were to be connected by a link carrying a block. The block was to be joined by a connecting-rod to the valve rod, and reversing was to be effected by raising or lowering the block end of the connecting-rod. Howe developed this idea by extending the lugs into long rods, and by providing a hanger for the suspension of the link from the reversing shaft. Howe's original pencil sketch and a rough wooden model of his motion which he made were in 1869—and we believe still are—preserved at South Kensington. Howe showed his model to Mr. Hutchinson, the manager of Messrs. Stephenson's works. Mr. Hutchinson at once saw the value of the invention, not only as a means of reversing but of varying the expansion. He immediately sent the model to Robert Stephenson, then in London, who, without delay, approved of the idea. At that time two locomotives, Nos. 70 and 71, were being built by Messrs. Stephenson for the North Midland Railway. They were to have been fitted with Dodd's wedge motion. One of them—No. 70—was so fitted, but the other was fitted with Howe's motion. The exact date on which Howe's motion was used for the first time in practice on an engine was September 10th, 1842. There were divided opinions at the time as to the merits of the invention, but Robert Stephenson settled the question by adopting it. He acknowledged that Howe was the inventor of the motion, and as reward instructed the cashier to make Howe a present of twenty guineas. Afterwards, in 1846, as a further recognition of the value of his invention, Howe was appointed engineer at the Stephenson Collieries and Ironworks, Clay Cross, Chesterfield, which position he was still occupying at the time when our article was published in 1869. Placed in a more independent position, he had opportunity for applying his link motion in many ways to various classes of engine. In 1847 he designed and applied with success a link motion to a winding engine for the first time. History has not forgotten Howe, even although his link motion is now probably permanently associated with Stephenson's name. It is evident, however, that Mr. Hutchinson, the works manager, played an important and praiseworthy part in recognising the full merits of the invention as soon as it was brought to his notice, and in forwarding particulars of it without delay to Robert Stephenson. It is also evident that more than a considerable share of Howe's inspiration was supplied by the idea communicated to him by the young apprentice Williams.

## Railway and Road Matters.

THE Metropolitan Railway Company is seeking powers to construct a railway from Preston-road Station to Great Stanmore.

THE London, Midland and Scottish Railway is constructing fifty fully insulated containers for the conveyance of perishable goods liable to deterioration if exposed to the atmosphere, especially chilled and frozen meat.

THERE have been many complaints of late in the Press of the long, wearisome walk through the subway at the City end of the Waterloo and City Railway, and it is satisfactory to learn that the Southern Railway proposes to improve this subway and to provide escalators.

THE London and North-Eastern main line is four-tracked from King's Cross to beyond Welwyn Garden City, except through Potters Bar Station, and for a mile or so to the south thereof. That distance includes the north and south tunnels at Hadley. It is now proposed to convert this double line into four tracks—possibly by opening out the tunnels.

IT is proposed greatly to improve Paddington and the adjoining Bishop's-road stations. The platforms at the former are to be lengthened so that none will be less than 1000ft. long. The two platforms at the latter station are to be replaced by two island platforms, and so provide for running lines. A subway is to be constructed between the two stations which will be in addition to the existing footbridge.

IT may be of interest if we add to our description, on page 562 of THE ENGINEER of November 22nd, of the "Relay" train description system, that, as related on page 574 of the issue of November 23rd, 1928, the need for improved means of describing to signalmen in advance the class and destination of approaching trains was discussed at the Institution of Railway Signal Engineers on November 14th, 1928.

THE completion of the Hu-hai Railway, running from the suburb of Harbin to Hailun, marks the beginning of the huge Chinese programme of construction in Manchuria. The Hu-hai Railway is a purely Chinese enterprise, capitalised at 10,487,709 dollars Harbin currency, with a total mileage of 220 kiloms. The railway has to its credit eight locomotives, 220 freight wagons with a capacity of 30 tons each; 50 passenger coaches, with a seating capacity for 100 persons each; and before the year ends ten more locomotives and 200 more freight wagons will be added to its rolling stock.

THERE have been from time to time sundry references in our Seven-Day Journal and in this column to the abolition of level crossings in the city of Hull. The subject was mentioned in the political notes in *The Times* of November 21st, as illustrative of a "much-needed" improvement which could be proceeded with under the schemes of the Lord Privy Seal, but an Act of Parliament must first be passed. Our contemporary remarked that the Law Officers of the Crown were considering the possibility of making some alteration in the procedure affecting the powers of municipal bodies which desire to promote schemes for the relief of unemployment.

A SERIOUS railway accident, by which three railway servants lost their lives, occurred outside the Bath Station of the London, Midland and Scottish Railway on the evening of Wednesday, November 20th. The scene of the disaster was where the Somerset and Dorset jointly owned line joins the L.M.S. The first 9½ miles of that line out of Bath falls towards that city on a gradient of at least 1 in 80, and in that length there are 4 miles of 1 in 50. A train of about thirty loaded coal wagons was descending towards Bath when apparently it got out of control, and, when rounding the curve at the junction with the main line, was derailed. The driver was killed, also two other men who were working in the adjoining goods yard. The coroner's inquest was opened on the following Saturday when the coroner ordered an autopsy of the driver.

THERE was an increase in 1928 over 1927 in both the fatal and non-fatal accidents to railway servants whilst working on the permanent way. The fatal cases were 63 and the non-fatal 67 in 1928 as compared with 52 and 53 respectively in 1927. Out of the 130 accidents in 1928 there were 58 caused by the failure of the men to act upon the warning received from the look-out men or to comply with the regulations; 35 to want of individual care in crossing lines, &c., or to lack of care on the part of other servants; 9 to the look-out man being at fault or personally careless; whilst 9 were accidental, and due to slipping or other causes. The remaining 19 came under what we would call an administrative cause. They were due to the protection of the men being inadequate, though a look-out man was available or obtainable.

ON Sunday, August 18th, a passenger train was admitted into No. 4 platform line at Hull, London and North-Eastern Railway, where it came into collision with an empty set of light coaches. There were no serious injuries. A factor in the case was that for entering this road there was provided a stop signal, together with a lower calling-on arm. Both signals were coupled to the same lever and track circuit determined whether the calling-on arm only, as indicating that the platform line was partly occupied, should be lowered, or whether the stop arm also, as showing that the line was free, should be put to "clear." As there were coaches in this particular road, the calling-on arm only should have been lowered, but both the driver and fireman maintained that they got the stop arm as well. Unfortunately, neither the signalman nor his mate saw the signal, and there were no witnesses to corroborate either their statement or that of the enginemen. There was a suspicion that the signalling was out of order, but tests, within 5 minutes of the accident and later in the day, failed to show any defect. The conclusion arrived at by Lieut.-Colonel Anderson, who inquired into the accident, is that the signalling was in correct working order, and that only the calling-on arm was lowered. Attention is drawn to the fact that, whilst the standard rule calls for trains to be brought to a stand before a calling-on arm is lowered, that rule is not worked to at Hull. Had it been so, this accident would not have happened. The company's explanation for its modification of the rule is that near this point there is a speed limit of 10 m.p.h.

## Notes and Memoranda.

AT present 32 million cubic feet of natural gas per day are uselessly burnt in Persia.

THE value of the paper and pulp produced in Canada during 1928 is put at 233,535,326 dollars, showing an increase of 6·5 per cent. during the year.

A FREEZING mixture, which has been patented in Germany, and is said to give a temperature drop of 31 deg. Cent., comprises 100 parts of ammonium chloride, 150 parts of sodium carbonate (anhydrous), and 300 parts of water.

ACCORDING to official statistics there are seventy-three cotton mills in China, which contain a total of 2,113,528 spindles, and 16,787 looms. The rate of growth of the industry was very rapid between the years 1919 and 1924, but has now become stabilised.

MASTER clocks at the Dominion Observatory, Ottawa, kept in the underground clock vault, are maintained as nearly as possible at a constant temperature. Paraffin-mercury and toluene-mercury thermostats are designed to turn the heat on or off for a change of one-hundredth of a degree in room temperature and to work for long periods without inspection. Two ordinary carbon lamps keep the room temperature at slightly under 76 deg. Fah., while two other lamps turned on intermittently by the thermostats hold the temperature practically steady at 76 deg.

THE test which aeroplane engines must pass at the American Bureau of Standards calls for running fifty hours in ten five-hour periods. One of these periods is at full throttle and full rated speed, the remainder at about 97 per cent. of rated speed and 90 per cent. of the rated horse-power. One engine of each type must pass this test without any serious structural failure and without more than three forced stops for any reason whatever. For each of the forced stops, if any, the engine is run an extra two hours. The engine is then tested for horse-power at different speeds, and records are made of its performance in all important respects, such as fuel and oil consumption, kind of fuel required, &c.

COMMENTING on the performance of the new twelve-engined German flying boat "Do X.," *Nature* says that an alighting speed of 90 miles an hour, as against 60 miles an hour for most British boats, is very high, implying as this does almost a full minute of running before rising; and coupled with a heavy h.p. loading of 18 lb.–19 lb., it would indicate that there is little reserve for adverse water conditions. Thus, when fully loaded, she would require to operate from relatively sheltered waters under prepared conditions. There is little reason to doubt that if the greater margin of safety insisted upon in Great Britain were to be sacrificed, corresponding advances could equally be achieved.

CASE-HARDENED nickel steel has proved, according to the *American Machinist*, highly successful as a material for tools used for broaching gunmetal castings, *e.g.*, brake handles. The tools stand up to their work well and are in every way superior to those made from plain carbon steel. In view of the fact that practically no re-grinding of broaches is possible, the cutting edge formed by case-hardening gives as long a life as the average tool steel; nickel steel also offers the very great advantage that the extremely tough core obtainable in this material minimises the danger of fracture to which tools made from high-speed steel are liable. The choice of tool materials and also the heat treatment and properties of the materials to be broached are discussed.

ACCORDING to the *Vossische Zeitung*, a commission has arrived in Berlin from Moscow to open negotiations for the reorganisation of the Russian aluminium industry. The Soviet Government intends to invest the sum of £3,000,000 in the industry, of which £200,000 is to be spent in Germany on the purchase of machinery and plant. The largest aluminium works are to be built close to the great water power station of Dnjrostroj and will have a yearly production of 4000 tons. It is hoped to have these works finished by 1933. According to the Russian five years' plan, the production of aluminium by that time should have reached 20,000 tons per annum. This is five times the requirements of Russia. Bauxite and argillaceous earth are found in considerable quantities in Russia, but they are not suitable for exploitation by the usual methods. The German United Aluminium Works Company has, however, according to the *Chemical Trade Journal*, after years of experiment, discovered a process of adapting the Russian bauxite to the manufacture of aluminium, and the Soviet Government is anxious to acquire this patent for Russia, or at least the licence to work it there. The German company has not succeeded in obtaining a patent for its process in Russia, although application was made several years ago.

ALTHOUGH the use of ferro-titanium in steel and iron manufacture is steadily growing in Great Britain, its consumption is only a fraction of what it is in other European countries and in America. Titanium is one of the best cleansing agents known; it unites with oxygen with great avidity, forming titanium oxide ($TiO_2$). It not only removes gas from iron and steel, but decomposes other less stable oxides which would otherwise remain in the metal on solidification. The reaction product rises to the surface with the slag. Titanium has, says the *Iron and Coal Trades Review*, a greater affinity for oxygen than manganese, hence the use of this alloy permits of substantial reduction in the quantity of ferro-manganese required. Nitrogen, which some authorities assert is very deleterious, is removed by titanium, as this is one of the metals which is known to combine with nitrogen at a high temperature, and the resulting titanium nitride passes into the slag. Additions of ferro-titanium yield a sound product, free from blow-holes. A carbon-free ferro-alloy should be used. This is readily soluble, and avoids the possibility of titanium carbide remaining in the steel, which is almost infusible at the temperatures employed. It is usual to add about 7½ lb. to 10 lb. of a ferro-alloy containing 20 to 25 per cent. titanium per ton of steel or iron. In some cases up to 30 lb. per ton is used, but even small additions of 2 lb. per ton have a noticeable effect on the strength of the product.

## Miscellanea.

THE power plant of the Yamaguchi Prefecture, Japan, is to be extended by the addition of a 54,000 kW steam turbine set.

A WATER reservoir is to be made near Calgary, Alberta, at a cost of 3,770,000 dollars. It will have a capacity of 3600 million gallons.

AN explosives factory is to be put up at Lichiakon, Manchuria, at a cost of £50,000, to supply the Fushun coal mines with blasting materials.

A BRIDGE to commemorate the 150th anniversary of the foundation of the city is to be built in Bangkok, by Dorman, Long and Co., of Middlesbrough, at a cost of £250,000.

THE American group of copper companies, which holds an option on the properties of the Cape Copper Company in South Africa, has decided to expend £2,000,000 on development work.

SOME experiments are being carried out in India on the utilisation of the shells of ground nuts for the manufacture of paper and artificial silk, with, apparently, successful prospects.

A FACTORY for the production of agricultural tractors is to be put up at Novosibirsk, Siberia. The cost of the works is estimated at £2,300,000, and its annual output is valued at £4,600,000.

IT is suggested that a ship recently launched from the Aalborg yard, Jutland, is the first which has ever been built for the bulk transport of cement. She has been built for American owners.

THERE has recently been completed the shipment of 8000 piles from British Columbia to Weehawken, New Jersey, for dock construction. The last consignment comprised 176 trees, each 125ft. long.

THE total effective horse-power of steam, gas, oil, hydraulic and electrical plant employed on all mines in the Federated Malay States during 1928 was estimated at 158,733, as compared with 138,601 in 1927 and 118,846 in 1926.

THE Ambassador Bridge over the Detroit River between Detroit, Mich., and Sandwich, Ont., was formally opened for traffic on November 11th, with ceremonies on both sides of the river, by Hon. Charles McCrea, Minister of Lands and Forests for Ontario, and the Hon. Frederick A. Green, Governor of Michigan.

A COMMITTEE has been formed to raise funds for the preservation of Dr. Nansen's old ship, the "Fram," which lies in dock in Norway in a serious condition, and is threatened with destruction. The committee includes Dr. Hugh Robert Mill (Vice-president of the Royal Geographical Society).

THE town of Edmonton, Alberta, is to be supplied with electric power, from Calgary, by an overhead line working at a pressure of 132,000 volts. This will be the highest voltage used in Western Canada, exceeded only by the Saguenay and Gatineau systems in the East, the latter of which works at 220,000 volts.

A DR. MANN Lecture on "The Examination of Coal and Coke by X-rays" was given by Mr. C. Norman Kemp, secretary of the Royal Scottish Society of Arts, at 8 p.m., on Wednesday, November 27th, at the Royal Society of Arts, John-street, Adelphi, London, W.C. 2. The chair was taken by Dr. Frank S. Sinnatt.

PARLIAMENTARY powers are to be sought for the amalgamation of six gas companies in South Yorkshire and Derbyshire. The companies are the Dinnington and District Gas, Staveley Gas Light and Coke, Whitwell and District Gas, Bawtry and District Gas, Beighton and District Gas, and Maltby and Bramley Gas Companies.

THE combine of semi-finished non-ferrous metal producers which was formed last year has, says the *Ironmonger*, collapsed, and as a consequence there is very keen competition between the Austrian producers, which has brought prices down considerably, affecting home and export markets. This naturally terminates the market protection and price agreement with Germany and Czechoslovakia.

THE real truth about the recent discoveries of coal in Northern Rhodesia is, says the *South African Mining and Engineering Journal*, gradually leaking out. As regards the alleged finds of coal in the bend of the Kafue River, in North-West Rhodesia, the authorities seem to be agreed that little importance is to be attached to the matter. The coal is of poor quality, the journal states, and transport difficulties make it unprofitable to mine. The Kanshanshi people are still hopeful, however, that it may turn out of some value, and money is being spent in prospecting in the neighbourhood. The other reported discovery of coal, that on or near the possible line of the much-discussed Sinoia-Kafue railway, is, apparently, to be taken more seriously. Several of the leading Rhodesian mining houses have acquired blocks of claims in the vicinity of the find, and money is being liberally spent in testing the merits of the coal. Even the Wankie people are watching developments, and have acquired an interest in the area.

PROVISION in Montreal Harbour for the importation of additional cargoes of fuel—coal and oil—has just been made by the Harbour Commissioners in the completion of a new wharf below the shipyards of Canadian Vickers, Ltd. Though the first vessel to discharge at the new section was the ss. "Dannedaike" with fuel oil from South America for the Joseph Elie Company, the new berths were created for steamers arriving from Great Britain with anthracite coal. The whole of 1000ft. of new wharf extension at harbour sections 56, 57 and 58, which is the first stage of a proposed extension of 3000ft., will be used to accommodate anthracite coal imported from Great Britain, though an oil pipe-line to storage tanks erected by the Joseph Elie Company on its own territory will also permit the unloading of the liquid fuel. Sections 27, 28, 29, 30 and 31, previously used as coal berths, will now be used for liner tonnage bringing in or sailing with general merchandise. New sheds will be erected at these sections.

# LIFEBOAT BUILDING AT WEST COWES, ISLE OF WIGHT

J. SAMUEL WHITE AND CO., LTD., SHIPBUILDERS AND ENGINEERS

(*For description see page 570.*)

FIG. 7—LIFEBOAT SHOP SHOWING HAULING-UP WINCH

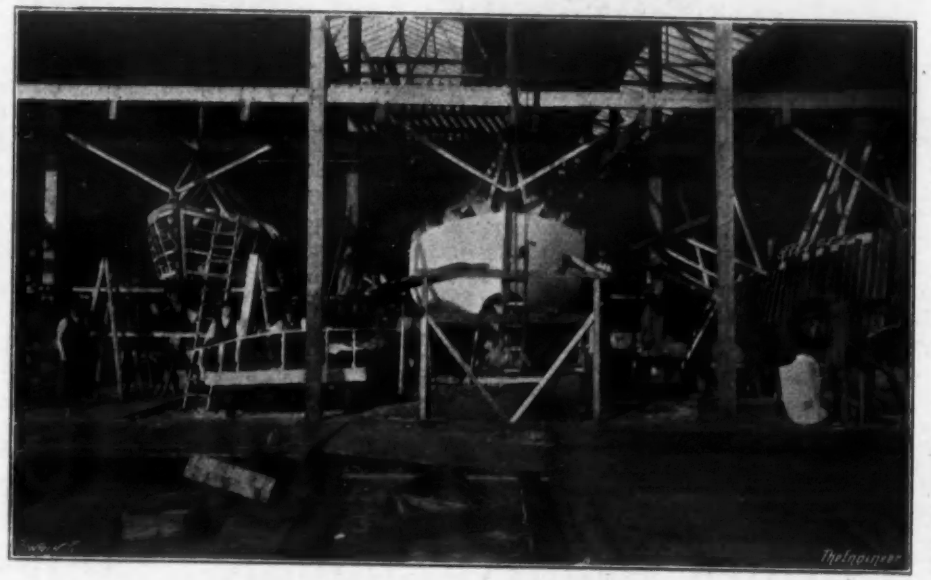


FIG. 8—VIEW IN LIFEBOAT BUILDING SHOP

FIG. 9—LIFEBOATS IN COURSE OF CONSTRUCTION

FIG. 10—LIFEBOATS APPROACHING COMPLETION

## The Engineer
## Annual Subscription Rates

**(Including postal charges).**

Subscriptions will be accepted by the Publisher direct or through a newsagent at the rates and in the currencies stated below :—

| | | | | |
|---|---|---|---|---|
| **BRITISH ISLES** .. .. | £3 | 5 | 0 | |
| **CANADA** .. .. .. | £3 | 3 | 0 | Thick Paper edition. |
| | £2 | 18 | 6 | Thin Paper edition. |
| **ABROAD** .. .. .. | £3 | 7 | 6 | Thick Paper edition. |
| (except Canada) | £3 | 3 | 0 | Thin Paper edition. |

| | |
|---|---|
| AFRICA .. .. | Central News Agency. All Branches |
| * £3 7s. 6d. | CAPE TOWN : Wm. Dawson and Sons, Ltd., |
| † £3 3s. 0d. | 29–31, Long-street (Box 489) |
| | JOHANNESBURG : C. Juta and Co. |
| ARGENTINE .. | BUENOS AIRES : Mitchell's Book Store, 576, |
| * £3 7s. 6d. | Cangallo |
| † £3 3s. 0d. | |
| AUSTRALIA .. | Gordon and Gotch (Australasia), Ltd. All |
| * £3 7s. 6d. | Branches |
| † £3 3s. 0d. | MELBOURNE : Robertson and Mullens, Elizabeth-street |
| BELGIUM .. | BRUXELLES : W. H. Smith and Son, 78–80, |
| * Fr. 590 | Rue du Marché-aux-Herbes |
| † Fr. 550 | |
| CANADA .. .. | American News Company, Ltd. All Branches |
| * $15·25 | MONTREAL : Gordon and Gotch, Ltd., 334, |
| † $14·25 | Notre Dame-street, W. |
| | TORONTO : Wm. Dawson and Sons, Ltd., 87, Queen-street East |
| | TORONTO : Gordon and Gotch, Ltd., 81, Queen-street West |
| CEYLON .. .. | COLOMBO : Wijayartna and Co. |
| * Rs. 44·5 | |
| † Rs. 41·5 | |
| CHINA .. .. | HONG KONG : Kelly and Walsh, Ltd. |
| * $37 | SHANGHAI : Kelly and Walsh, Ltd. |
| † $34·5 | |
| EGYPT .. .. | CAIRO : Express Book and Stationery Store, |
| * £3 7s. 6d. (Pt. 330) | 9, Chareh Maghrabi |
| † £3 3s. 0d. (Pt. 308) | |
| FINLAND .. | HELSINGFORS : Akademiska Bokhandeln, |
| * M. 650 | Alexandersgatan, 7 |
| † M. 605 | |
| FRANCE .. .. | PARIS : Boyveau and Chevillet, Rue de la |
| * Fr. 418 | Banque, 22 |
| † Fr. 390 | PARIS : Berger Leverault, 229, Bld. St. Germain |
| | PARIS : Brentano's, 37, Av. de l'Opera |
| | PARIS : Dunod, 92, Rue Bonaparte |
| | PARIS : W. H. Smith and Son, 248, Rue de Rivoli |
| GERMANY .. | BERLIN–LICHTERFELDE–WEST : H. Hermanns, Dahlemer Strasse 64 A |
| * R. mks. 70·00 | WESTERN GERMANY : Fritz Rohfus, Blumenthalstrasse 10, Cologne |
| † R. mks. 65·00 | LEIPZIG : K. W. Hiersemann, Konigstrasse 29 |
| HOLLAND .. | ROTTERDAM : Hector's Boekhandel, Noordblaak 59 |
| * Fl. 41·00 | ROTTERDAM : Techn. Boekhandel, "Plan C," |
| † Fl. 38·00 | Gelderschestraat 4 |
| INDIA .. .. | BOMBAY : Thacker and Co., Ltd. |
| * Rs. 45 | CALCUTTA : Thacker, Spink and Co. |
| † Rs. 42 | |
| ITALY .. .. | MILAN : Ulrico Hoepli |
| * Lire 300 | ROME : Maglioni and Strini, 307, Corso |
| † Lire 280 | ROME : Fratelli Treves, Corso Umberto1, 174 |
| | ROME : Fratelli Bocca |
| | TURIN : Rosenberg and Sellier, v. Maria Vittoria 18, and their Branches at Naples and Rome |
| JAPAN .. .. | Maruzen Co. All Branches |
| * £3 7s. 6d. | |
| † £3 3s. 0d. | |
| JAMAICA .. .. | KINGSTON : Educational Supply Co. |
| * £3 7s. 6d. | |
| † £3 3s. 0d. | |
| NEW ZEALAND | AUCKLAND : Whitcombe and Tombs, Ltd. |
| * £3 7s. 6d. | Gordon and Gotch, Ltd. All Branches |
| † £3 3s. 0d. | NAPIER : J. Wilson Craig and Co. |
| RUSSIA .. .. | LENINGRAD : Mezhdunarodnaya Kniga, Prospect Volodarsky, 53 A |
| * £3 7s. 6d. | |
| † £3 3s. 0d. | MOSCOW : "Litisdat," Kousnetsky Most, 5-15 |
| STRAITS SETTLEMENTS | SINGAPORE : Kelly and Walsh, Ltd. |
| * $29·25 | |
| † $27·25 | |
| SWEDEN .. .. | STOCKHOLM : A/B Wennergrens Journal-expedition, Stockholm 1 |
| * Kr. 61·00 | |
| † Kr. 57·00 | STOCKHOLM : A/B C. E. Fritzes Kungl., Hofbokhandel, Fredsgatan, 2 |
| SWITZERLAND | BERNE : Joh. William De Groot, Laupenstr. 5 |
| *Fr. 85·20 | ZURICH : Rosa Loibowicz, 4, Ankerstr. |
| † Fr. 79·50 | |
| UNITED STATES | International News Co., 131, Varick-street, |
| OF AMERICA | New York, N.Y., and all Branches |
| * $16·40 | Entered as second-class matter at the Post Office, |
| † $15·25 | New York, N.Y., December 12th, 1896, under the Act of March 3rd, 1879 (Section 397, P.L. & R.) |

* *Thick Paper.* † *Thin Paper.*

*These rates are liable to alteration if exchange fluctuations require it.*

*** READING CASES *to hold two copies of* THE ENGINEER, *cloth sides and leather backs, can now be supplied at 4s. 9d. each, 5s. 3d. post free.*

### "THE METALLURGIST."

This Supplement, which deals with the Science and Practice of Metallurgy, both ferrous and non-ferrous, is published free with the last issue of THE ENGINEER in each calendar month.

### ADVERTISEMENTS.

**The charge for Classified Advertisements is 1/- per line up to one inch—minimum charge 4/-; those occupying one inch or more at the rate of 12/- per inch. Orders must be accompanied by a remittance. The rates for Displayed Advertisements will be forwarded on application. Classified Advertisements cannot be inserted unless delivered before TWO o'clock on Thursday afternoon (the day before publication).**

*Letters relating to the Advertisement and the Publishing Department of the Paper are to be addressed to the Publisher, all other letters are to be addressed to the Editor of* THE ENGINEER.

### THE ENGINEER DIRECTORY.

This Directory, which is published annually in the interests of advertisers in THE ENGINEER, may be obtained free of charge on application to the Publisher.

**Postal Address, 33, Norfolk-street, Strand, W.C. 2.**
**Teleg. Address, "Engineer Newspaper, Estrand, London."**
**Telephone Nos. Temple Bar 2256, 2257.**

*By arrangement with Reuter's Engineering Service,* **The Engineer** *contains the latest news from all parts of the world which is likely to be of interest to engineers.*


## Contents.


THE ENGINEER, November 29th, 1929. PAGE

A SEVEN-DAY JOURNAL .. .. .. .. .. .. .. .. .. 569
THE SHIPYARD AND ENGINE WORKS OF J. SAMUEL WHITE AND CO., LTD., AT COWES, I.O.W. No. I. (Illus.) .. .. .. 570
THE MODERNISATION OF JAPAN .. .. .. .. .. .. 572
A VISIT TO THE B.T.H. WORKS. (Illus.) .. .. .. .. 573
BATTERSEA POWER STATION AND SULPHUR .. .. .. .. 576
PERRAN FOUNDRY .. .. .. .. .. .. .. .. 577
THE SPONTAN TRANSMISSION GEAR FOR MOTOR VEHICLES. (Illus.) 578
LETTERS TO THE EDITOR—
The Taxation of Industry .. .. .. .. .. .. .. 580
Canal Transport .. .. .. .. .. .. .. .. 580
Science and Legislation .. .. .. .. .. .. .. 580
SIXTY YEARS AGO .. .. .. .. .. .. .. .. 580
RAILWAY AND ROAD MATTERS .. .. .. .. .. .. 581
NOTES AND MEMORANDA .. .. .. .. .. .. .. 581
MISCELLANEA .. .. .. .. .. .. .. .. .. 581
LEADING ARTICLES—
Salesmanship .. .. .. .. .. .. .. .. 583
The Fatigue of Metals .. .. .. .. .. .. .. 584
LITERATURE .. .. .. .. .. .. .. .. .. 584
PUBLIC WORKS, ROADS AND TRANSPORT EXHIBITION. No. II. (Illus.) .. .. .. .. .. .. .. .. .. 586
A HIGH-SPEED AMERICAN GRINDING MACHINE. (Illus.) .. .. 590
RATIONALISATION .. .. .. .. .. .. .. .. 590
NICKEL AND ITS USES IN ENGINEERING .. .. .. .. 590
CANADIAN ENGINEERING NEWS .. .. .. .. .. .. 590
PROVINCIAL LETTERS—
The Midlands and Staffordshire .. .. .. .. .. .. 591
Lancashire .. .. .. .. .. .. .. .. .. 591
Sheffield .. .. .. .. .. .. .. .. .. 592
North of England .. .. .. .. .. .. .. 592
Scotland .. .. .. .. .. .. .. .. .. 593
Wales and Adjoining Counties .. .. .. .. .. .. 593
PERSONAL AND BUSINESS ANNOUNCEMENTS .. .. .. .. 593
CATALOGUES .. .. .. .. .. .. .. .. .. 593
CURRENT PRICES FOR METALS AND FUELS .. .. .. .. 594
FRENCH ENGINEERING NOTES .. .. .. .. .. .. 595
BRITISH PATENT SPECIFICATIONS. (Illus.) .. .. .. .. 595
FORTHCOMING ENGAGEMENTS .. .. .. .. .. .. 596

16-PAGE SUPPLEMENT—"THE METALLURGIST."


### NOTICES TO READERS.

*** *If any Subscriber abroad should receive* THE ENGINEER *in an imperfect or mutilated condition, he will oblige by giving prompt information of the fact to the Publisher, with the name of the Agent through whom the paper is obtained. Such inconvenience, if suffered, can be remedied by obtaining the paper direct from this office.*

*** *All letters intended for insertion in* THE ENGINEER *or containing questions should be accompanied by the name and address of the writer, not necessarily for publication, but as a proof of good faith. No notice whatever can be taken of anonymous communications.*

*** *No undertaking can be given to return drawings or manuscripts, correspondents are therefore requested to keep copies.*

## The Metallurgist.

**THE NOVEMBER NUMBER OF THE MONTHLY METALLURGICAL SUPPLEMENT TO "THE ENGINEER" ACCOMPANIES THIS ISSUE.**

### DEATH.

On November 21st, at The Cedars, Low Fell, HENRY NOBLE, sen., Chairman and Managing Director of Noble and Lund, Ltd., of the Northern Machine Tool Works, Felling-on-Tyne.

# THE ENGINEER.

*NOVEMBER* 29, 1929.

### Salesmanship.

"WE ask that everyone should realise that there is a critical situation to be faced; that in the national interest our evidence should be examined without prejudice and without delay; and that each individual reader should approach the subject with a fixed determination to apply to his own trading organisation any lessons which our evidence has to teach him, and to accept that evidence in the spirit in which it is tendered, that of a desire to be of service to British industry at home and British commerce abroad." These are the last words of an interim report of Mr. Francis W. Goodenough's Committee on Education for Salesmanship, which was issued yesterday. We have put them in the first place because they draw attention at once to the seriousness of the problem which the Committee was called to investigate, and because they indicate the spirit in which the Committee has worked and reported. Its object is to arouse the interest and concern of British traders and to bring home to them an appreciation of an economic situation which is assuming serious proportions. The report is necessarily critical. The hasty reader may condemn it on that account. He may say that it is damaging to the prestige of British merchants, and that the country ought not to parade its weakness before the world. The Committee foresaw the probability of that charge, and we agree with it in its refutation of it. The good that may be achieved by a little plain speaking may easily outweigh the inconvenience of publicity. Furthermore, whilst this first report is only critical, we are promised in a final report an outline of a constructive policy. But since the mere recital of ills—particularly ills of omission—is often sufficient to indicate the means for removing them, we may hope that the remedies will have been applied before the Committee concludes its labours.

The Committee is a large one, and the members of it cover a large diversity of interests, amongst which the engineering industry is adequately represented. We can speak with no direct knowledge of other industries, but as far as engineering is concerned, we see no course but to endorse the general statements made in the report; we venture to add, however, that a change for the better has been taking place during recent years. "Our evidence," says the Report, "shows that British salesmen are often not as well equipped as they should be for the difficult and important work which they have to perform." It would be of the greatest interest to know if the engineering trade is a serious offender in that respect. We may admit, perhaps, that the knowledge of foreign languages is not as good as it might be, but most firms of repute now send overseas men of "good character and attractive personality," and in possession of sufficient knowledge to answer on the spot questions of a technical character. Indeed, some of the largest concerns are in the habit of sending abroad men of the highest positions in industry, whilst others have permanent foreign staffs in which at least one engineer is included. If they do no more in that respect the reason is to be found in the high cost, and, in some cases, in a not unnatural reluctance to pay a commercial engineer abroad a higher salary than his technical brother can earn at home. We do not know if the same feeling is found in other industries; probably not, at any rate, to the same extent. We do not mention these facts with any intention of excusing the engineering industry as a whole or diverting from it the general allegations of the Committee. It, as much as any other, stands in need of ever-improving salesmanship. What it has done so far, other nations have also done—sometimes better—and it must, therefore, be ceaseless in its endeavours. In the engineering industry the days of the "bagman" are passing. Men of good general education and of liberal tastes are required. Many of the best orders are secured under what may be described as social conditions, and experience has shown that men who have acquired *savoir faire* at public schools and universities make, with the necessary training, excellent salesmen. Germany has been particularly quick to recognise the value of attractive personality, and few who have business dealings with them can forget the delightful human touch which they bring into commerce. Once this aspect is fully recognised by merchant and manufacturer, once it is understood that the best trade representative is not the type of man that can be snubbed or told to wait in the hall, we shall see schools and universities taking a greater interest in the training of men for this vocation. The old idea that the commercial traveller is sufficiently equipped if he has a cast iron exterior, is able to write in a flimsy book a business report, and to work out discounts in his head, has gone for ever in the greater engineering industries. They call for a better quality of man, and such men are gradually entering them. Although the Report before us does not expressly say so, we shall do it no injustice if we read between its lines a belief in the need to educate the merchant and manufacturer in the necessity of more efficient salesmanship through the employment of better *personnel*, and the desirability that parents, schools and universities should recognise that salesmanship opens careers for which well-educated men are required, and in which they need no longer fear loss of status. The events of recent years have done much to remove the old, and in the circumstances not unnatural, prejudices. Just as we see in marine engineering a very different type of man from those who held tickets thirty years ago, so we are now seeing in the more important branches of engineering salesmanship men of good education, social qualities, and technical knowledge.

It has not been possible in this place to do more than reflect the spirit of Mr. Goodenough's Committee, but we sincerely trust that this preliminary report will be studied in detail by many of our readers. Lest we should have given an impression to the contrary, we desire to say emphatically that throughout it is moderate in tone. It is never didactic; it is rather a lament than a sermon, and from the first page to the last it is full of interest. It touches upon many very familiar subjects—the British neglect of foreign languages, the indifference to the special requirements of

foreign markets, the exaggerated belief that British goods will sell themselves on their prestige—but that was unavoidable. What it has to say on these subjects is put forward with due consideration of the causes that have led up to them, and is supported by quotations from the witnesses examined by the Committee. There is now a general consensus of opinion that improved salesmanship is one direction in which British trade may look for a way out of its troubles. This first Report may do much to further that object if it is read in the spirit in which it is written, and is not hastily cast aside by those who are satisfied that they "know their own business best."

### The Fatigue of Metals.

THE fact that iron can eventually be broken by the repeated application of a load far too small to have any effect if borne steadily has been known for at least eighty years. The metal is said to have become fatigued by the continual repetition of stress, as if its cohesive forces had ultimately become too exhausted to support any longer a tension quite moderate as compared with its original strength. The word "fatigue" is now so firmly established as connoting the effects of many times repeated stresses that there is nothing to be gained by criticising it. On the other hand, its use must not be allowed to imply anything more than the facts warrant. Whatever may be the cause of the fatigue of metals, the fatigued condition is certainly something different from a time effect, for not only could an equal or heavier load be borne indefinitely without fatigue, but the intermittent character of the fatiguing load involves periods of rest, if not of recuperation, which might reasonably be expected to extend rather than diminish the time before failure occurs. The basis of our experimental knowledge of fatigue is the fact, verified by countless observers, that all ordinary metals will break after sufficient repetitions of a stress substantially less than would cause fracture in the first instance. We also know, with equal certainty, that there is no simple relationship, even for any one metal, between the intensity of the stress and the number of repetitions required to break the metal. Over a certain range, it is true to say that the lower the stress the greater the number of times it must be applied before the inevitable failure occurs. But, happily for engineers, the law changes. Otherwise, it would only be a matter of time before the collapse of every structure subject to the least vibration. Experience seems to indicate and experiments confirm the view that, provided the stress does not exceed some definite amount, it may be applied and re-applied as often as desired without injury to the metal. This maximum stress which the metal will bear repeated for ever is known as the fatigue strength. If it be surpassed by ever so little, a million repetitions or so may bring about fracture, while at any lower stress hundreds of millions of repetitions cause no injury, and there is no reason to believe that any number whatever would do so. The definiteness of the fatigue strength is a curious fact, and almost equally curious is the observation that all the steels and ferrous metals, no matter what their composition or the nature of their heat treatment, have a fatigue strength ranging practically always between 40 and 55 per cent. of their ultimate tensile strength—a point of considerable interest to designers.

Such in outline is the knowledge of fatigue gained from an ordinary fatigue-testing machine. It is sufficient to be very useful, but far from adequate to provide an explanation of what fatigue really is. Scores of workers in the principal physical laboratories of the world have been attempting to discover the reason for the failure or the non-failure of metals under repeated stresses. They have found out many things in their investigations, many of them seeming to increase the complexity of the problem rather than to suggest its solution. An early and plausible view was that a metal would never become fatigued so long as the stress on it was kept within the elastic limit of the material. Conversely, fatigue would be bound to occur sooner or later if the elastic limit was repeatedly exceeded. This conception of things would identify the fatigue limit with the elastic limit, and render the former term superfluous. But since the elastic limit defined as the stress at which plastic deformation begins is not only very indefinite, but is certainly lower for many materials than the fatigue limit, the identity of the two cannot be admitted. The elastic limit has obviously been exceeded when plastic deformation of the metallic crystals has occurred, yet according to Dr. Gough, in the whole experience of the National Physical Laboratory, covering all sorts of metals subjected to all sorts of stresses, no case has ever been encountered in which the slip bands indicative of plastic yielding have not been apparent at stresses which would never fatigue the material. Nor is there any difference to be detected between the slip bands due to a fatiguing and a non-fatiguing stress. We must therefore look elsewhere to find the cause of fatigue. Wohler discovered, some sixty years ago, that the range of stress to which a metal is subjected has a much more important bearing on its endurance under fatigue than the maximum intensity of the stress, although when the latter is high the permissible range is small. Except that a specimen which is going to break eventually will last longer the less the variation of the stress it has to bear; and that if the range of stress is reduced to zero, so that the load becomes constant, the metal will show its maximum strength, it is difficult to see what is to be deduced from Wohler's discovery. A study of a large number of tests has shown that in the case of mild steel, the safe range of stress decreases in a more or less parabolic curve from its maximum to zero, as the mean stress increases from zero to the value of the ordinary breaking stress. With other metals, however, the relationship is more nearly illustrated by a straight line, so that no helpful generalisation can be stated. Another factor, which might be thought to affect the endurance of fatigue is the rapidity with which the successive loads are applied. This point has also been thoroughly studied, notably by Professor Jenkin, at Oxford, who has found out that at reversals of stress up to a rate of 3000 per minute, there is no apparent speed effect. Speed, indeed, would seem to make little or no difference to the fatigue strength until the reversal of stress attains a frequency of 7000 per minute, after which the strength increases more and more rapidly with the frequency up to the hundreds of thousands of reversals per minute to which the experiments extended. It may not be too fanciful to imagine that at a sufficiently high frequency, stress and relief might follow each other so quickly that the metal simply had not the time to follow the alternations, and thus would oppose an infinite rigidity to the forces tending to destroy it. However this may be, the phenomenon does not appear to throw much light on the nature of failure by fatigue. A more fruitful discovery is the fact that surface defects such as small scratches have a considerable influence on lowering the fatigue strength. This, taken in conjunction with the demonstration by Professor Haigh that the fatigue strength of metals is also reduced by contact with any liquids which could produce a chemical effect on the metal, leaves little room for doubt that fatigue failure, whatever it may be, commences at the surface of the metal. The crystal boundaries, where they intersect the surface, might be accused of causing lines of weakness, but they must be exonerated for the reason that a fatigue failure is a fracture across the crystals themselves, and not a separation between them. Moreover, as Dr. Gough pointed out when he reviewed the whole question of fatigue recently before the Royal Society of Arts, test pieces formed from single crystals, and therefore having no intercrystalline boundaries, suffer from fatigue as much as ordinary metal. Suspicion therefore has to fall on the slip bands caused by the crystal layers sliding on one another and forming minute irregularities in the surface when the metal is strained. But even if the slip bands must be held accountable, their effect is highly obscure. That they cannot act as scratches or other surface irregularities seems clear from an experiment recounted by Dr. Gough in the lecture referred to. A test piece made from a single crystal was subjected to alternating stresses greater than its fatigue strength. The slip bands which occurred were polished off on seven different occasions during the test, and after seven million reversals of stress no further slip bands were produced, nor could any surface cracks be detected by the microscope. The test piece broke after a further two million reversals and no slip bands whatever could be seen in the neighbourhood of the fracture. It was evident that the fracture had been propagated without any further slip. It must also be remembered that the existence of slip bands is compatible with an indefinite life of the specimen provided that the fatigue strength is not exceeded.

The question of the failure of metals by fatigue has been studied by Karl Ljungberg at Stockholm, whose conclusions have been made available to English readers by a summary of his work in the September number of our Supplement THE METALLURGIST. This investigator has arrived at the view that fatigue is a measure of the work done by hysteresis. When a specimen is subjected to varying or alternating stresses the strain produced lags behind the stress, with the result that the stress-strain diagram for a cycle of stress takes the form of a "hysteresis loop." The area of the loop evidently represents work done on the metal, and it is Ljungberg's contention that the specimen will break when the aggregate of all the hysteresis work becomes equal to the total work required to break the metal in the ordinary way. There is a plausiblity about the argument, but it seems clearly untenable in the light of results obtained at the National Physical Laboratory and elsewhere, with which Ljungberg appears to be unacquainted. Professor Gough has found hysteresis to persist unchanged in Armco iron for 100,000,000 reversals of stress, and he considers it a firmly established fact that a metal subjected to repetitions of a safe range of stress will finally achieve a state in which, although no further permanent set will appear, strain hysteresis will be present, and will continue indefinitely without causing fracture. It would also follow, if Ljungberg's view were true, that no metal could be permanently resistant to fatigue, for even the smallest hysteresis work per cycle continually repeated must soon add up to a total equal to any possible strength the metal may originally have had. Thus one more theory has to be discarded, though, even were it justified by facts, it would do little to explain them. The one thing that does seem certain about fatigue is that it is intimately connected with what happens amongst the molecules when the crystal planes slide over one another under the influence of stress. The regular lattice work of the atoms is distorted on the planes of cleavage, and X-ray examinations seem to indicate that the surfaces become wrinkled into waves as the atoms or elementary crystal units are rolled over by the tangential forces. When we know just a little bit more about the mechanism of the distortion of a crystal we shall be a long way further towards understanding the reason for the sudden fracture of a crank shaft or the snapping of a railway axle by fatigue.

## Literature.

*The Electrical Industry in Great Britain: Organisation, Efficiency in Production, and World Competitive Position.* With 88 statistical tables. London: The British Electrical and Allied Manufacturers' Association. Price £2 2s. net.

ALTHOUGH the electrical industries have assumed a new and increasing importance in the economic configuration of the country, no survey has yet appeared which allows one to estimate the present strength of the industry and to define its position among those economic developments which are determining the balance of economic power in the world. The present volume, however, which represents the work of almost two years 'continuous economic research into the main factors governing the growth of the industry and the development of its present prominence in export markets, discusses in detail the modernisation of equipment in basic industries and shows how, through electrification, a new period of economic prosperity should take place in this country. It also contains proposals advanced on behalf of the electrical industry for the expansion of production at home, and the strengthening of the competitive position abroad, and in view of the interest that is at present being taken in the unemployment question, these proposals have considerable significance. The picture given is that of an industry advancing steadily in strength and in productive capacity during the post-war decade at a time when other industries in the country have been seriously depressed. It is shown that the industry has gone through two cycles of prosperity and depression since the conclusion of the war. The year of greatest prosperity was 1921, following on the trade boom of 1920, but the engineering lock-out and trade depression generally caused a very heavy slump in 1922. Recovery was very rapid from this period of slump, with a maximum output in 1926. Since 1926 a period of fairly steady output has intervened, accompanied by falling prices and an increase in volume as measured in horse-power. This increase in volume has had its effect in the absorption of more labour on the one hand and a serious reduction in profits on the other.

The purpose of the second chapter is to show the economic status of the electrical manufacturing position, with special reference to manufacturing plant and machinery; to show that, measured by ordinary economic standards, the industry is efficient and is capable of dealing with any rapid expansion that takes place in the market; to prove that the prices charged by it have fallen very much more rapidly than general wholesale prices, with a resultant benefit to the consumer; and to make clear that the industry has been

saved from the worst consequences of trade depression through the combination of rationalisation in manufacturing processes, amalgamation in groups between individual firms to form manufacturing groups, and co-operation between all firms and all groups in a central association. In succeeding chapters the authors deal with the possibility of expansion and the state of demand in the main markets available to the electrical manufacturer. It is pointed out that in a country like Great Britain, dependent on a high volume of industrial production to support its population and equally dependent on a very large export trade to maintain its international balance of payments, the significance of exports is greater than in self-contained countries like the United States or even Germany. The total exports of all electrical and allied products reached the highest point in 1926, at about £20,350,000, including condensers. In 1927–28 a considerable fall took place, but the returns for 1929 show that a new record will probably be established. On the heavy generating plant side and in railway electrification material, as well as heavy transmission and distribution equipment, the industry has made very rapid progress indeed, and this progress must be due not merely to marketing enterprise, but also to the increasingly important part played by achievements as represented by operating performances in creating a powerful export goodwill. The competitive strength of the industry has not been evenly distributed over all products, the balance tending in favour of electrical machinery, and a similar observation applies to the territorial distribution of those exports. In countries where technical practice is predominantly British and the consulting engineers have been educated in British universities and workshops, there is a marked preference for the British product. A similar observation applies to countries where foreign practice predominates.

The Dominions have been responsible for the greatest percentage of British export trade, the present figure being in the vicinity of 65 per cent. In 1903 South Africa was the main market, but exports to it showed practically no improvement during the entire period 1903–1918, the years 1907, 1910 and 1916 being alone years of heavy shipment. That would indicate either that, industrially, South Africa has developed very slowly or that the British competitive position was growing steadily weaker from 1903 onwards. A combination of both these factors probably provides the best explanation. India came second in importance in 1903 and remained practically stationary for four years. From 1907 onwards began what may be regarded as the first stage in Indian industrial expansion, resulting from the establishment of the Indian jute manufacturing and cotton spinning industry, and this expansion continued without interruption until 1914, and was resumed in great volume from 1919 onwards. Australia showed the most rapid and in some ways the most spectacular advance of all three. It began to progress definitely from 1907 onwards, and the rate of acceleration became steeper every year, with the result that exports in 1912 were five times those of 1903. During the war years the Australian market was supplied by America, but from 1920 onwards American domination began to fall away, and Britain shared again in the remarkable post-war developments that have taken place in that country. A less marked upward movement took place in New Zealand, with the exception that from 1903 to 1913 it moved up without interruption and continued until 1916. The war affected it from 1917–1919. Canada has always been an American preserve, and the British figures are therefore no indication of the state of industrialisation in that country, although it is worth noting that even there British exports improved very rapidly from 1903-1912.

Europe now represents the greatest market open to electrical manufacturers and has taken the place of the British Dominions and Colonies in this respect. The recovery of Europe as a whole is shown by the very large increase in exports from the five competing countries. They have moved from £20,500,000 in 1920 to no less than £27,671,000 in 1928, an increase of 35 per cent. In this increase Britain has participated to the extent of £670,000, but Germany and the United States secured practically all the advance recorded. German exports increased by £2,500,000 and American by £2,250,000. The reason for such an advance in the case of the United States may, on close investigation, be discovered in American financial penetration as represented by investment in public utilities accompanied by control, and, secondly, in the establishment of closer relations between the American manufacturing firms and European subsidiaries. As a result of this penetration America has been able to double its exports in the course of one year. An investigation shows that the whole of this increase is to be found in telegraphic and telephonic apparatus, in cables and subsidiary equipment, the increase in machinery being small. One can, therefore, look on this American invasion of Europe as due to factors either beyond the control of the British manufacturer or beyond his range of interests. In machinery alone, Britain supplied 12·7 per cent. of the market in 1927 and 10·7 in 1928, while in apparatus its production fell from 13·2 per cent. in 1927 to 12·9 in 1928. For apparatus and machinery combined the percentage in 1927 was 13 and in 1928, 12·1 per cent. Reparations are undoubtedly responsible for improvement in German figures.

The position of the export market is analysed minutely, and certain recommendations are made regarding the possibility of developing this market more efficiently in the future. The expansion of the home market is then considered and the limits of power production during the next twelve years are estimated as follows:—Industry, 16,500,000,000; commercial, 4,500,000,000; domestic, 3,400,000,000; agriculture, 720,000,000; traction, 2,400,000,000; and other purposes, 1,000,000,000, giving a grand total of 28,520,000,000 units. Two of these items, namely, traction and agriculture, are, however, considered to be capable of considerable expansion. It has been assumed that main line electrification will not be introduced to any great extent and that rural industries will not be an important feature in economic development during the next twelve years. Judging from results obtained in other countries, notably Switzerland, France, and Germany, a total consumption in excess of 11,000,000,000 units might be expected if all the railways were electrified, but vested interests are strong enough to ensure that that will not take place. In the next chapter on the Reorganisation of Electricity Supply, the opinion is expressed that there is no reason why the output of electricity in this country in the future should not exceed 50,000,000,000 units instead of the 28,000,000,000 units fixed as a preliminary saturation point, whilst in the following chapter it is explained that the main directions in which electrical power consumption may be stimulated are in the order of importance, industry, transport, commerce, and shipping, agriculture and domestic services. Industry is, and will be, the area of greatest potential demand, and any policy aiming at the revival of industry must be favourable to the increasing consumption of electricity. Above all, the purpose of the survey is to show that the industry is efficient in spite of obstacles placed in front of its natural expansion; that, measured by the standards available, it can take its place among the leading industries of this country and bear comparison easily with the United States and Germany in technique or production in the equipment of its factories and in administrative capacity.

---

*Experimental Building Science. Vol. II.: An Introduction to Mechanics and its Application in the Design and Erection of Buildings.* By J. Leask Manson, B.Sc. Eng., M.I. Struct. E., M.R.S.I., and Francis E. Drury, M.Sc. Tech., M.I. Struct. E., F.I.S.E. Cambridge: At the University Press. 1929. Price 18s. net.

Though the second of a series, the first volume of which relates to "the application of elementary science to simple building problems," this book is complete in itself as a work, quoting from the preface, ". . . devoted to the development of the more elementary and relevant sections of mechanics, including elasticity and the strength of materials, and to the application of this knowledge to well-known forms of building construction . . ." The nature of the book, as indicated by the title proper, would, however, be better expressed by the inclusion of the words "in its application" instead of "and its application." The three sections treat respectively of conditions of static equilibrium, beams and elastic bending, and important structural problems. There are, throughout, applications to very well described and clearly explained examples, and useful exercises are set in the form of problems which are similar to or variants of those worked out. The 292 figures include not only such as are common to most works on the subject, but also others of some originality. The latter include diagrams in three dimensions, often very usefully aiding the text, and diagrams showing how forces can be determined by means of models, the figures, apart from recourse to such experiments, having a value of their own, as illustrating the matters under discussion. Although they adequately present ranges of conditions, as in the loading of beams and struts, and the nature and positions of their supports, the authors have avoided undue elaboration in such respects, including, however, some details the forces acting upon which are not so frequently described.

It is a characteristic of the work that good judgment has been exercised in regard to what must be included and what can usefully be added, matter under the latter head including the solution of problems by methods having an organised experimental basis, instead of the acceptance of traditional or empirical rules. This is one of the special purposes of the work, as set forth in passages in the preface, so clearly explanatory of certain conditions, respecting structural work at the present time, as to deserve more than passing notice. The authors contend that knowledge and experience gained by the widespread employment of structural steel and reinforced concrete might usefully be applied to older methods of building construction, but that they have not in that respect fully replaced traditional usage. Further, that this is in part due to the fact that ". . . while it has been relatively easy to oust the older, traditional, and less well-advertised methods of building construction, it has proved to be much more difficult to establish—even in these times of rapid change and readjustment—a common tradition of design and technique in the new materials, and to replace the large bodies of technical and craft skill which have thus been rendered ineffective." Allusion is also made to disappointing results in the use of the new materials, and the authors deprecate too much reliance being placed upon any one material, pointing to the importance of the principle that choice of materials should be made from amongst all, whether tested in the laboratory or by time. This liberal attitude, in sharp contrast to that of some writers on building subjects, has usefully influenced the authors' work, which contains two very good chapters on masonry and one on timber construction, considered in the light of experimentally evolved mechanics. The same influence is evident in the treatment of some parts of the subject as applied to the employment of the newer materials and methods, notably in respect of the stability of cranes and forces in masts and derrick towers.

As the speed of a squadron is that of the slowest ship so must the form and substance of such a work as this be such as can serve the need of students; but Mr. Manson and Mr. Drury have succeeded in fulfilling this requirement without allowing it to cramp their style. Using the simplest mathematics proper to each case, they have produced an attractive and convincing work which will be widely appreciated by engineers, architects, and draughtsmen.

## SHORT NOTICES.

*Pipe and Tube Bending and Jointing.* By Stanley P. Marks. London: Sir Isaac Pitman and Sons, Ltd. 1929. Price 6s.—This is an essentially practical little book. It deals in detail with the technology of pipe bending and jointing in various metals, and is well illustrated by diagrams of operations, appliances of various kinds, sections of joints, and so on. The author says in his Preface that in the writing of it "an endeavour has been made to place the subject-matter before its readers in such a manner that it may be of help to the beginner, of instruction and guidance to those lacking experience in pipe work, and also a ready reference in pipe and tube work generally." In our opinion, the author has succeeded in his endeavour and has produced a book which will appeal to the claims of readers he had in mind.

---

*Metal Pickling: A Short Treatise.* By E. E. Wynn. Manchester: Charles Sever, Ltd. 1929. Price 2s. 6d.—This might better be described as a "very short treatise," for the essential part occupies no more than twenty-six small pages, but it is obviously written by a thoroughly practical man, and though there may be some differences of opinion about some of the views he expresses—on Inhibitors, for example—even experts will read what he has to say with interest, and non-technical men in the industry will study it with advantage.

## BOOKS RECEIVED.

*High Voltage Cables.* By L. Emanueli. London: Chapman and Hall, Ltd., 11, Henrietta-street, W.C. 2. Price 8s. 6d. net.

*Belt Elevators.* By H. Davies. London: The Draughtsman Publishing Company, Ltd., 96, St. George's-street, S.W. 1. Price 3s. net.

*Machine Design.* By P. H. Hyland and J. B. Kommers. London: McGraw Publishing Company, Ltd., 6 and 8, Bouverie-street, E.C. 4. Price 20s. net.

*The Teaching of Mechanical Drawing.* By R. P. Hoelscher, M.S. London: Chapman and Hall, Ltd., 11, Henrietta-street, W.C. 2. Price 12s. 6d. net.

*Elementary Structural Problems in Steel and Timber.* By C. R. Young, B.A., Sc., &c. London: Chapman and Hall, Ltd., 11, Henrietta-street, W.C. 2. Price 17s. 6d. net.

*High-voltage Cables: Theory and Practice of their Design and Operation.* By P. Dunsheath. London: Sir Isaac Pitman and Sons, Ltd., Parker-street, Kingsway, W.C. 2. Price 10s. 6d. net.

*Transport Co-ordination: A Study of Present-day Transport Problems.* By K. G. Fenelon, M.A., Ph.D. London: P. S. King and Son, Ltd., Orchard House, Westminster, S.W. 1. Price 6s. net.

*Gaseous Combustion at High Pressures.* By W. A. Bone, D.Sc., &c., D. M. Newitt, Ph.D., and D. T. A. Townend, Ph.D. London: Longmans, Green and Co., Ltd., 39, Paternoster-row, E.C. 4. Price 42s. net.

*Mechanical Equipment of Buildings. Vol. I.: Heating and Ventilation.* Second edition. By L. A. Harding, B.S., M.E., and A. C. Willard, S.B. London: Chapman and Hall, Ltd., 11, Henrietta-street, W.C. 2. Price 50s. net.

*Blast-furnace Practice. Vol. III.: Operation and Utilisation of Subsidiary Products.* By Fred Clements, M. Inst. C.E., M.I. Mech. E., &c. London: Ernest Benn, Ltd., Bouverie House, Fleet-street, E.C. 4. Price £3 3s. net.

*Western Australia: Thirty-first Annual Report, Balance Sheet, &c., of the Metropolitan Water Supply, Sewerage and Drainage Department for the Financial Year ended June 30th, 1929.* Perth: John Lee, Acting Government Printer. 1929.

*Filtration and Air Filters: An Outline of the Art.* By J. A. Pickard, B.Sc., &c. With a section on the "Mechanical Aspects of Filtration," by A. J. W. Underwood, M.Sc. London: Ernest Benn, Ltd., Bouverie House, Fleet-street, E.C. 4. Price 45s. net.

*Kenya and Uganda Railways and Harbours: Report of the Acting General Manager on the Administration of the Railways and Harbours for the Year ended December 31st, 1928.* London: His Majesty's Eastern African Dependencies, Royal Mail Building, Cockspur-street, S.W. 1. Price 5s. net.

# Public Works, Roads and Transport Exhibition.

No. II.*

### Wallis and Steevens, Ltd.

On the stand of Wallis and Steevens, Ltd., there were two road rollers and various machines for the making and maintenance of roadways. One of the rollers was an 8-ton steam-driven machine and with it our readers are already familiar, but the other—designated by its makers as the "Advance" Motor Roller, Type A—is a new production. It is illustrated in the engraving, Fig. 11. It has an underslung forecarriage, and the maker's special cambering axle which we described some years ago and which has proved, they inform us, very successful with their steam-driven rollers. There is overhead steering with a roller-bearing head, and the reducing gear is ball-mounted. The engine has four cylinders. There are four speeds in both directions, and two brakes are fitted. Grease gun lubrication is employed throughout.

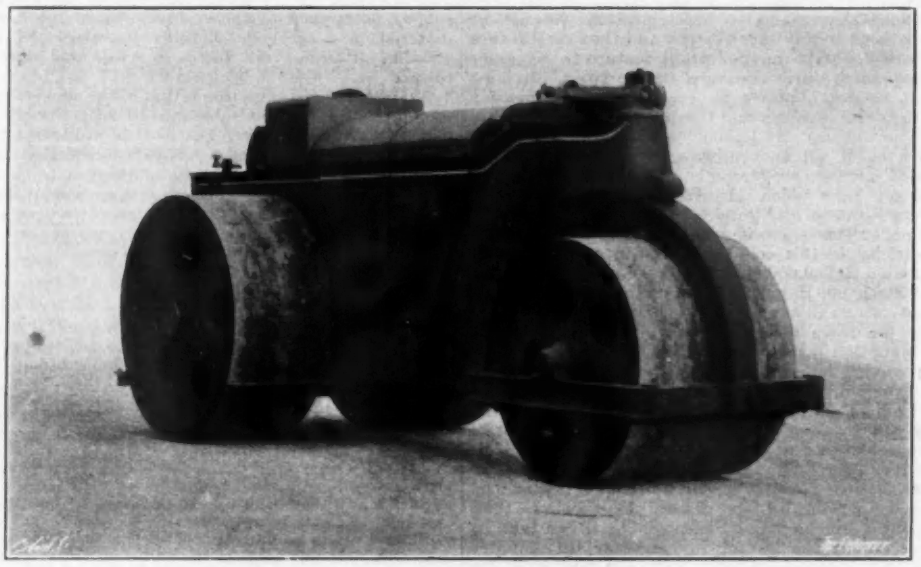


Fig. 11—Motor Roller—Wallis and Steevens

### R. H. Neal and Co., Ltd.

There was a varied collection on the stand of R. H. Neal and Co., Ltd., of Longfield-avenue, Ealing, W., a firm which specialises in machinery for excavation, trench digging, tunnelling, &c., for sewer work. Mention may be made of the "Austin" and "Barber-Greene" trench diggers, bucket and wagon loaders and unloaders, and portable belt conveyors. A novelty was what the firm has called its "Rapid" crane, which, it is explained, is a "4 in 1" crane. For instance, it can be mounted on wheels and furnished with a revolving jib for use in general building work, drains, trenches, excavations, foundations, &c. Or it can be provided with a tall mast having a cross arm, supported by a truss, which has a pulley at each end to take the hoisting rope. Or, again, it can be fitted with two mast extensions so that it can reach a height of 35ft. Finally, it can itself be bolted to an elevated staging while its operating mechanism is at ground level. It is driven by a small petrol engine which is said to consume only half a gallon of petrol per day, to lift up to 6 cwt., to have a capacity of 15 tons per hour when used as an ordinary jib crane, and to be capable of lifting at least 10 tons per hour to second storey level. A view of a couple of these little cranes engaged in trenching operations is shown in Fig. 12. The underframe and base are of steel and the grooved wheels which are fitted can be used to run either on 24in. or metre-gauge rails by reversing them. The jib will describe a complete circle.

Fig. 12—"Rapid" Cranes—Neal

### Johnston Brothers.

The main stands of Johnston Brothers, of 79, Mark-lane, London, E.C. 3, occupied their customary positions at the entrance to the Gilbey Hall, and were, as usual, attractive in appearance. All the big things shown, however—the asphalt plant, the tar boilers, &c.—as well as the small patcher, &c., had been exhibited and described before. There were, though, three small but useful novelties. They were: a mechanical gritter, a drum cutter, and what is termed a "Dandy" truck.

The gritters ordinarily employed by road authorities have capacities of from 5 to 6 tons of grit. In hilly country, however, such large and heavy vehicles are subject to objections, and it was to overcome the latter that Messrs. Johnston have introduced the little gritter shown in Fig. 13. It has a capacity of from 25 cwt. to 35 cwt. of material, and the hopper is at such a height that it can be loaded direct from a lorry. Arranged beneath the storage hopper is a horizontal cylindrical drum which acts as a feeder from the hopper through the medium of a final distributing chute to the road surface. The quantity of grit delivered at any time is controlled by a horizontal shutter, corresponding in width to the width of the feeding roller. These gritters, which are provided with draw-bar attachments, are also fitted with mechanical vibrators in the form of a series of small hammers which agitate the lower portion of the hopper itself. These agitating hammers are only required when the grit is of a damp and clinging nature, when their action greatly facilitates the uniform discharge. The feed roller is driven from one of the road wheels, two of which are mounted on solid rubber tires, whilst the third takes the form of a castor which adapts itself to the direction of travel and therefore facilitates turning within a very restricted space. The standard width of the feed roller, and therefore of the gritting, is 6ft., and in the model illustrated the wheels come inside the gritting width, but an alternative type of construction is supplied with the wheels outside the gritting width. The general purpose of these gritters is to follow immediately behind a tar or bitumen distributor for the purpose of resurfacing a road, covering the binding agent with grit to give a non-slippery surface. By appropriate adjustment of the control shutter, moreover, the amount of grit fed to the road surface can be reduced to a very small amount, so that in frosty weather the same machine can be used towed behind an ordinary lorry for spreading grit to avoid slipping on frosty or ice-bound roads.

Fig. 13—Mechanical Gritter—Johnston

The drum cutter, which is illustrated in Fig. 14, acts as a vehicle for the conveyance of drums of bitumen from point to point along the highway to be charged into boilers. The old process of opening drums of bitumen, in cases in which the bitumen is solid at ordinary temperatures, was by the use of an axe, a process which is slow and awkward and not without risk to the man using the axe. With the drum cutter, after making a small incision with the axe in the metal of the drum, the rest of the cutting process is effected by means of a flexible steel wire, which is pulled through the middle of the drum and the contents of the drum much in the same way as a cheese wire is employed for cutting cheese. The only external aid necessary is a small amount of lubrication of the flexible wire with oil or paraffin, which has the effect of preventing the two severed surfaces of bitumen from again adhering together before the cutting process is complete.

Fig. 14—Drum Cutter—Johnston

The "Dandy" truck—Fig. 15—which is a two-wheeled hand trolley in its essential characteristics, has been specially introduced for handling drums of cold emulsions used, more particularly during the winter months, for repair work. The legs are made collapsible, so that when a fresh drum of material is loaded on to the truck no lifting is needed, as the handles of the truck, with the legs collapsed, come down to the ground level, and, owing to the provision of two small rollers within the frame, the new loaded drum is easily pushed up the handles into its working position. This small appliance is also supplied with an outlet valve, which is of wedge shape, and is fitted into the bunghole of the drum. With the aid of this valve, emulsion is either discharged into pouring cans or, alternatively, allowed to flow directly on to the road surface through the medium of the discharge

Fig. 15—"Dandy" Truck—Johnston

* No. I. appeared November 22nd.

or distributing tray, which is detachable and is shown on the ground to the left in the engraving.

### Frederick Parker, Ltd.

Frederick Parker, Ltd., of Leicester, in addition to showing, as usual, examples of concrete mixers, crushing rolls, granulators and crushers of various types, and a combined hoist and engine, had on view a new type of sand and gravel washer, for which great things are claimed. For instance, it is asserted that, owing to its unusual construction, this new washer, a view of which is given in Fig. 16, uses less water and needs less power to drive than is usual. By a system of baffles and lifters a contra-flow of water against the material is maintained, the clean water entering at the

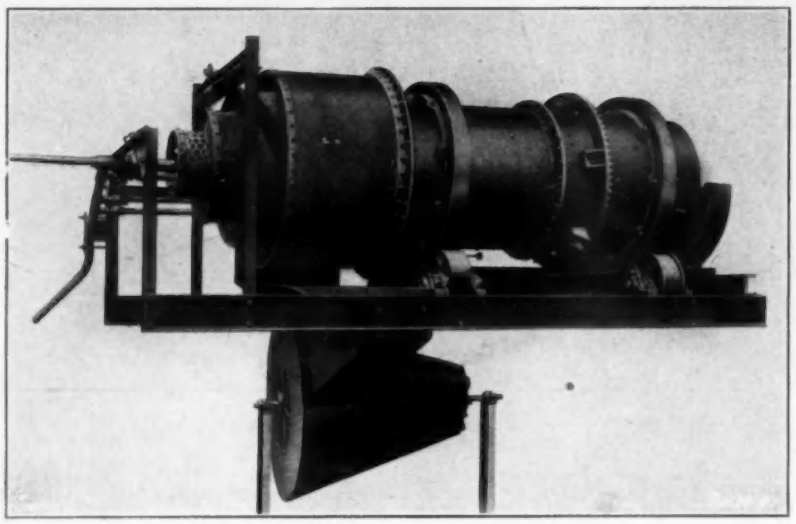


Fig. 16—Sand and Gravel Washer—Parker

discharge end of the washer and the dirty water flowing over the baffle ring at the feed end. In this way, the initial washing is carried out by the used water, while, as the material proceeds through the washer, it meets cleaner water until it is discharged into the screen on the end of the washer, where it is finally washed by a spray of clean water. By the aid of baffles inside the washer a good depth of water is maintained. The sand and gravel undergo constant agitation by means of the lifting and conveying blades which are placed throughout the whole length of the washer, while the material is prevented from backing out by the short worm conveying blades fitted at the feed end of the washer. The lifting blades are so designed as to prevent "balling" of the material. A water spray and idling rollers to keep the screen clear are fitted to each screen. Stop valves are arranged in the water pipes for the adjustment of the water consumption. The makers inform us that tests carried out with this washer before experts have proved that it takes up less space, uses less water, and requires less power to drive it than any previously known types. The horse-power needed to drive it is given as being 6 B.H.P.

### Winget Ltd.

Demonstrations of machines in operation have always been features of the displays on the stands of

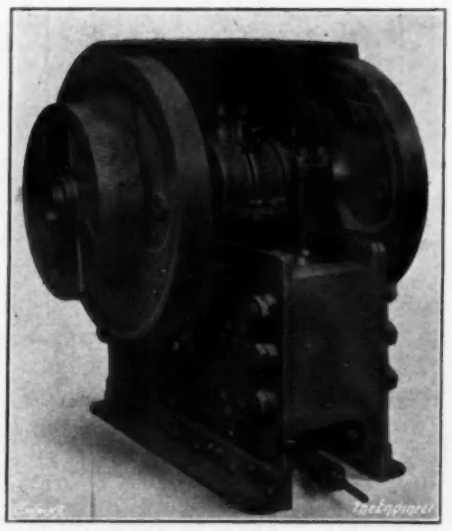


Fig. 17—Stone Crusher—Winget

Winget Ltd. at exhibitions of this class. This year the firm was showing in operation the 1929 models of its patented open-drum mixer fitted with a semi-helix drum which is said to result in an even faster and better mix than has hitherto been achieved. Then, too, there are the machines for making kerbs, slabs, bricks, and similar things. The slab machine, by the way, is claimed to be capable of turning out from 800 to 1000 slabs per eight-hour day. This output is, the makers assert, rendered possible largely by the automatic closing of the mould box, which is operated by one movement of one hand, and by the special counterpoised tamping plate, which is extremely easy to control. The brick machine is credited with an output of from 3000 to 4000 concrete bricks per day of eight hours, the bricks measuring 9in. by 4 $\frac{5}{16}$in. by 2$\frac{3}{4}$in.—frogged or plane. A novelty on the stand was the stone crusher which is illustrated in Fig. 17, the view showing the back view of the machine, in which may be seen the top portion of the swing jaw holder with the excentric bearings and the Stauffer lubrication. The machine is known as the 14in. by 9in. size and it has an output of 12 tons per hour when driven at 260 r.p.m. by an 18 to 20 H.P. motor or engine. The unit has been specially designed for ease of transport and shipment, the weight being $\frac{1}{2}$ ton and the construction sturdy. There is also a lifting hook in the swing jaw holder. There is, too, a guard to prevent stones from entering between the fly-wheels, the bearings or the side plates, so that the bearings may be kept free from dust and dirt. The fly-wheels are 3ft. 8in. in diameter and the belt pulley is 3ft. in diameter with an 8$\frac{3}{4}$in. face.

### John Allen and Sons (Oxford), Ltd.

John Allen and Sons (Oxford), Ltd., can generally be relied on to exhibit something original. This year it took the form of what they call the "Oxford Waveless," Roller which is shown in Fig. 18. As will

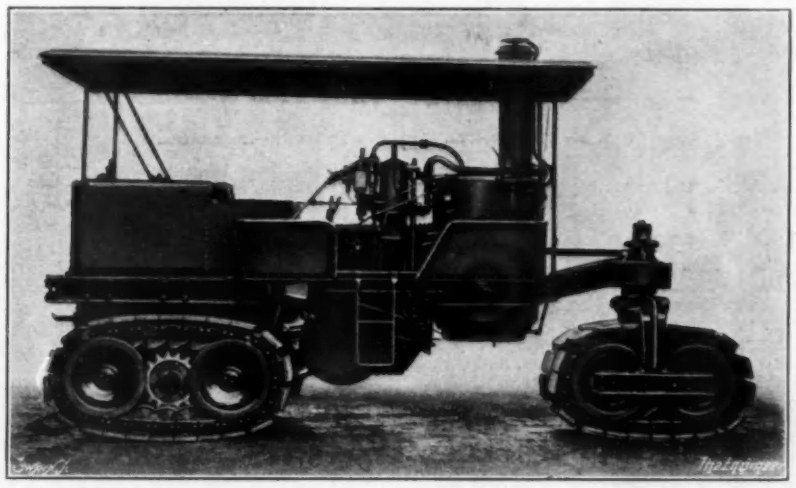


Fig. 18—"Oxford Waveless" Roller—John Allen

be seen, the machine, instead of being carried on wheels, is mounted on flexible tracks of the girder type, which are designed to lock to a diameter of 16ft. 6in., with the result that, in effect, the machine operates as though it had rollers of that diameter, as indicated in the diagram, Fig. 19. The roller is steam driven, steam being produced by a vertical boiler with inclined water tubes, and a superheater. The engine is a twin-cylinder, double-acting, high-pressure machine, and is fitted with poppet valves, and an oil-tight crank case. A differential gear is built into the crank shaft, and the drive is taken off both ends of the latter through a gear reduction and chains to the rear live axle, which is fitted with manganese steel pinions that gear direct into the teeth on the track. The drive is transmitted to the lowest track shoe in contact with the ground. No transmission stresses are conveyed through the track link pins. The rear live axle does not carry any weight, but two weight-carrying axles connect the rollers of the rear track units. A dog clutch, which is provided on the rear live axle, has the effect of locking the differential. Contracting brakes are fitted to the rear live axle.

The normal speed of the roller, when at work, is 2 m.p.h. and, when travelling, 3 m.p.h. Steering is effected by hand through worm and wheel and rack and pinion. A large water tank is provided, and, in addition to feeding the boiler, part of it can be used for ballasting purposes.

This roller has been introduced to obviate the formation of "waves" on bituminous and similar road carpetings, such as may be produced by the ordinary wheeled roller, and it is claimed that, for that purpose,

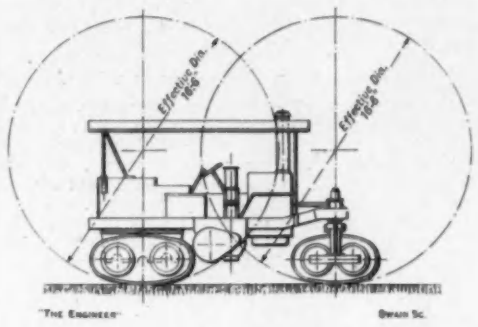



Fig. 19—Effective Diameter of Rollers

it appears to be entirely successful. It is also claimed to possess the following characteristics:—(*a*) Owing to the large radius of the curvature of the tracks the area in contact with the ground for any given depth of sinkage is much greater than that of a normal roller wheel, while at the same time the angle of approach is very much less. That, Messrs. Allen point out, enables the "Waveless" roller to traverse and consolidate earth fillings, embankments and the like, in a manner which the ordinary wheeled roller is totally incapable of undertaking; and (*b*) the "Waveless" roller may be said to have a variable weight effect. In the early stages of compression the area of contact with the ground is considerable, and therefore the compressive effect slight, but as consolidation proceeds the area of contact becomes reduced until, ultimately, the effect is similar to that of a 10-ton roller with standard wheels.

### H. R. Marsden, Ltd.

H. R. Marsden, Ltd., of Leeds, had again arranged a very interesting exhibit, nearly everything shown possessing novelty. There was, first of all, a 24in. by 20in. "X" type lever-motion stonebreaker, designed for reducing materials to 5in. size and under at the rate of approximately 45 tons per hour. It is claimed that this machine is particularly suitable for dealing with the very hardest materials, and is capable of producing a maximum output with a minimum of power. Lever and toggle mechanism is, of course, the basis of the design. This type of ma hine is built in sizes ranging from 8in. by 6in. to 30in. by 24in. Then, there was a set of 30in. by 16in. crushing rolls, fitted with machined chrome steel roll shells. The machine is specially designed for crushing to small sizes, viz., $\frac{1}{4}$in. and under. The frame is of heavy box-type construction, and all crushing stresses are absorbed and equalised by heavy forged steel tension rods. All the bearings are removable and interchangeable. The shells can be supplied with plain, chequered, or toothed surfaces, according to the

particular service required. These rolls are built in sizes ranging from 20in. by 12in. to 48in. by 20in. Then, there was a set of "zig-zag" jaws, which are particularly designed for dealing with material of a flaky nature, and of all classes. The irregular formation of the teeth is stated to produce an excellent sample with a minimum of oversize. On the stand, too, was what Messrs. Marsden term a "Niagara" counterflow screen No. 3 double-deck. The positive action of this type of screen is said to secure both horizontal and vertical vibration against the flow of material, so that all adhering particles are loosened and immediately passed through the open meshes, with the result that closer separation is obtained. The "Niagara" will handle either wet or dry material. The last machine to be mentioned is a "high-duty," ventilated, magnetic pulley and separator, 30in. wide. These pulleys and separators are intended for removing iron and steel from all kinds of materials. In crushing, grinding and pulverising plants they remove "tramp iron" that may have entered the material, and thus protect machines from injury and breakdown.

### The Ingersoll Rand Company, Ltd.

The stand of the Ingersoll Rand Company, Ltd., of 165, Queen Victoria-street, London, E.C. 4, was almost bewildering in the number and diversity of the exhibits displayed. There were, of course, all sorts and kinds of tools to work with compressed air, as well as air compressors. One of the latter, which is being shown for the first time and is illustrated in Fig. 20, is a new type of single-cylinder straight-line machine. In it the inlet and discharge valves are arranged radially round the cylinder to give maximum economy consistent with durability. The cylinder, which is of the barrel type, is water jacketed at the sides and head. The company's patented plate air valves, which operate entirely independently of any moving valve gear, are employed. The engine exhibited is one of a range of capacities intended for pressures of from 80 lb. to 100 lb. They can be driven from an electric motor by short belt drive attachment or by a long belt from line shafting. They can also be coupled direct to electric motors or oil engines. The makers claim that the horizontal design and special features of this machine render it particularly suitable for use as a compressor for handling all commercially used gases.

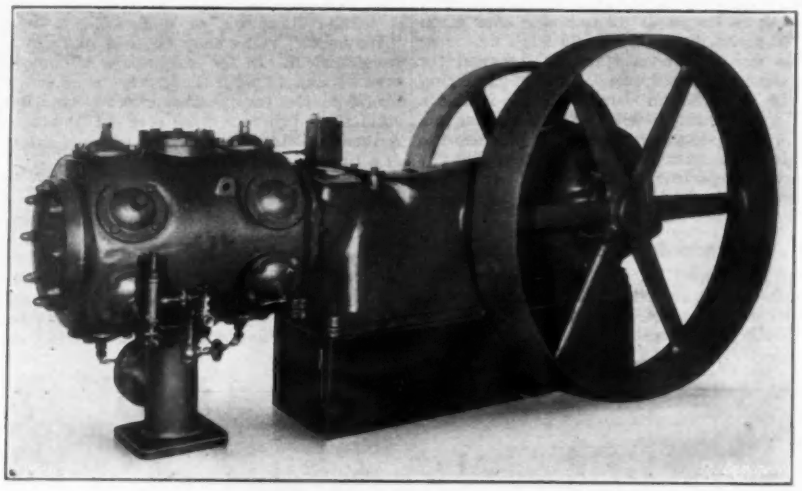


Fig. 20—Horizontal Air Compressor—Ingersoll

### Millars' Machinery Company, Ltd.

The stand of Millars' Machinery Company, Ltd., of Pinner's Hall, London, E.C. 2, contained the customary array of machinery of varying type and natures. Among them may be mentioned a 10-ton low temperature dryer, a brick breaker, various types of pumps, one of them shown in operation, and several concrete mixers. The firm has recently introduced some important improvements into its last-mentioned machines, and one of them, which embodies those improvements, was on view. It is illustrated in Fig. 21. It is known as the Millars'-Jaeger 10/7-L mixer, and the great advantage claimed for it is that it is almost entirely automatic. It has a capacity of 10½ cubic feet of unmixed material and of from 7 to 9 cubic feet of mixed material. The mixing drum has a maximum diameter of 38in., a depth of 32½in., and an opening 20in. in diameter. The dumping gear is so designed that the mixing drum automatically locks into the required positions of charging, mixing and discharging, respectively. The weight of the drum is taken on a ball thrust bearing. The loader bucket is mounted on a cradle with a double pivoted hinge in such a way as to give an exceptionally steep angle of discharge. The actuating clutch is of the cone type, lined with Ferodo and furnished with means for adjustment. The control is effected by a single lever which operates both clutch and brake. The clutch can be locked in the "in" or "out" positions by means of a toggle lever. Should the control lever be accidentally released while the bucket is being lowered to the ground, the latter is automatically held by the brake so that it does not fall heavily and get damaged. There is an automatic shaking device which comes into play immediately the bucket is fully raised, and continues to vibrate the latter until the operator begins to lower it. This vibration is claimed to ensure a rapid discharge of the aggregate, even when it is wet, and to accelerate materially the feeding so that a larger output is effected. The machine is operated by a Bamford single-cylinder vertical 4½ B.H.P. hopper-cooled engine. The crank case of the latter is hinged at crank shaft level and, by removing four bolts, the cylinder, with the water hopper and the top half of the crank case, may be hinged over in one piece, so as to give access for adjustment or renewal to the main bearings, connecting-rod, piston, timing gear, &c. The overall dimensions of this machine are as follows:—Width, with bucket down and drum in mixing position, 9ft. 5in.; width, with bucket up and drum in mixing position, 6ft. 8in.; height, bucket down, 7ft. 9in.; height, bucket up, 8ft. 9in.; length, 8ft. 3in.; wheel base, 5ft. 11in. centres. Its net weight is 30 cwt.

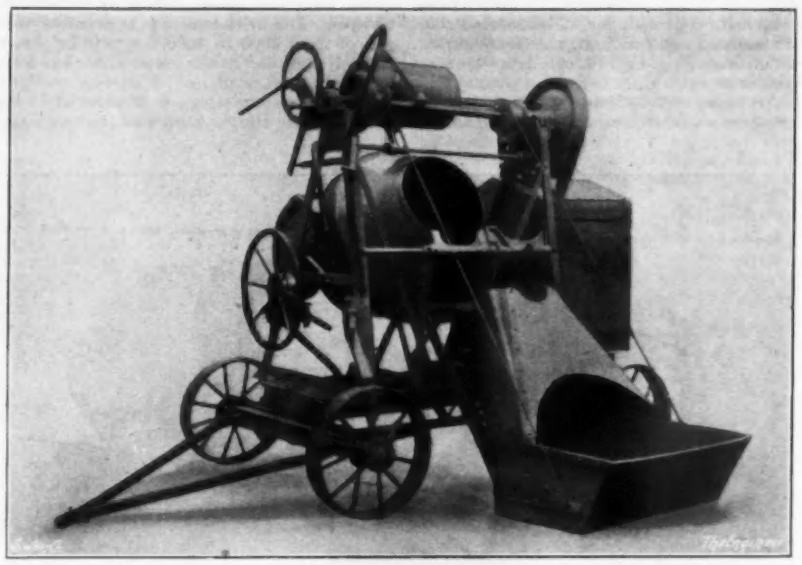


Fig. 21—Concrete Mixer—Millar

Quite another type of novelty, though it, too, is concerned with concrete making, was the batch cart which is illustrated in Fig. 22. This comparatively humble accessory has only been introduced quite recently, but it is said to have met already with a very favourable reception. It is, in actual fact, nothing more than a steel hand barrow, the hopper of which is divided into three divisions by means of three hinged depending steel plates. The three divisions are intended to hold gravel, cement and sand, and their relative capacities are such that if they are filled with the three materials the exactly required proportion of the ingredients for a given "mix" are obtained. The positions of the depending flaps or plates are fixed so as to give an average mixture, but the capacities of the divisions may be altered by inserting wood liners next the steel plates. The following advantages for this cart are claimed by the makers:—Exactly the same proportions of materials are given to each batch; the contents of the cart are shot together into the hopper of the mixer; the trouble of gauging is avoided; the use of one man and three barrows is saved; less supervision is required, time is saved, and output is increased.

Fig. 22—Batch Cart—Millar

### Guest and Chrimes, Ltd.

An interesting stand was that of Guest and Chrimes, Ltd., of Rotherham, who are concerned with the manufacture of valves, water meters, &c. &c. Among a number of other things they had on view were three new designs of meters shown in operation,

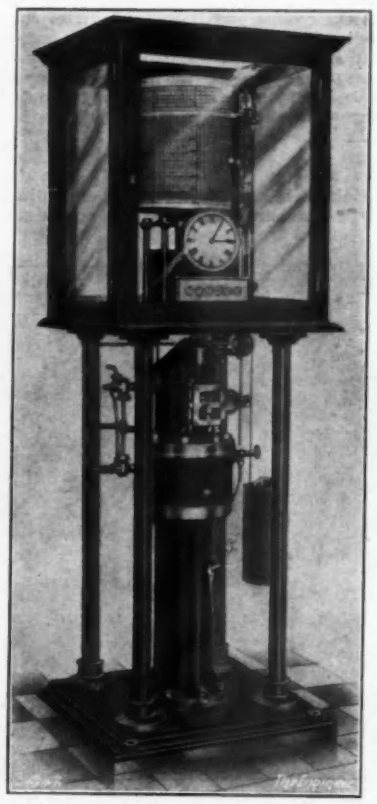


Fig. 23—Type R Recorder and Integrator—Guest and Chrimes

though not quite under full service conditions. All three have only recently been completed and are just being put on the market. Connected to a Venturi tube was what is termed a Type R Recorder and Integrator. This instrument, which is shown in Fig. 23, records the momentary flow of the fluid passing through the Venturi tube on an equally-spaced diagram and also indicates it on a uniformly-divided scale. It has a continuous integrator, which registers the total quantity of fluid delivered and records the pressure of water in the main. This type of recorder has a range of registration of 1 : 16, and it is claimed

FIG. 24—TYPE B. 2 E. RECORDER AND INTEGRATOR—GUEST AND CHRIMES

to register to within 2 per cent. of standard measure down to one-eighth of the maximum delivery, and to within 4 per cent. for the remainder.

Connected to the orifice flange of the Venturi was also another instrument which is designated the Type B.2.E Recorder and Integrator, and which is illustrated in Fig. 24. This instrument also records the momentary rate of flow—in this case on an equally spaced circular diagram—and indicates it on a uniformly divided dial, as well as being furnished with a continuous integrator for registering the total quatnity of water delivered. It has a range of regis-

FIG. 25—WEIR RECORDER—GUEST AND CHRIMES

tration of 1 : 6 and the makers state that it registers to within 2 per cent. of standard measure down to one-quarter of the maximum delivery, and to within 4 per cent. for the remainder.

The Weir Recorder, illustrated in Fig. 25, was shown mounted on a measuring tank fitted with a V notch. This instrument records the momentary rate of flow on an equally-spaced diagram, indicates it on a uniformly-divided dial, and has, too, a continuous integrator registering the total quantity of water delivered. We understand that this Weir Recorder is suitable for recording the flow over rectangular notches as well as over V notches.

All three instruments were beautifully made and their general appearance is well shown in the engravings.

### BROOM AND WADE, LTD.

Broom and Wade, Ltd., had on view an entirely new design of self-contained portable air compressor. It is intended to pass 150 cubic feet of free air per

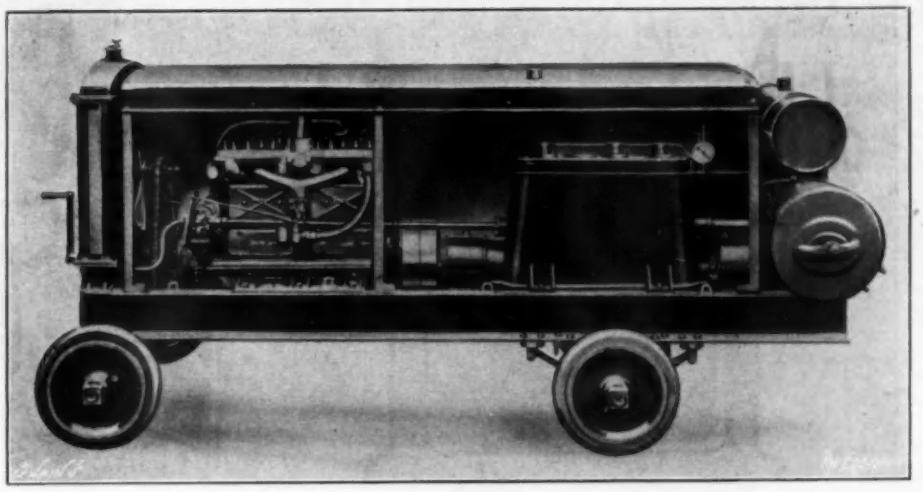


FIG. 26—PORTABLE AIR COMPRESSOR—BROOM AND WADE

minute compressed to 100 lb. per square inch, and to be capable of operating three heavy-duty road breakers or three Jack-Hammer type rock drills, or, alternatively, an equivalent number of other pneumatic tools, such as clay spades, trench rammers, riveting, chipping and caulking hammers, &c. The plant is illustrated in Fig. 26. The power unit employed is a 35 B.H.P. Dorman petrol engine, which runs at 1100 r.p.m. The compressor comprises three cylinders, cast monobloc, each cylinder having a bore of 6in. and a stroke of the same dimensions. It is designed to operate at 600 r.p.m., and the reduction of speed from that of the engine is effected by means of "Garrard" gears. A Broom and Wade automatic centrifugal clutch is arranged between the engine and the compressor to facilitate starting.

The compressor inlet and delivery valves, which are of the automatic thin-plate type, are embodied in the cylinder head, the whole being water cooled. Access to each pair of valves can be obtained by simply removing a square cover, and, in addition, the cylinder head is, itself, detachable. Bearing adjustments are simplified, since, in the design of the crank case, motor car engine practice has been closely followed. The bottom half can be removed with the compressor still in position in the chassis. The water cooling of the two units—engine and compressor—is effected by a large-capacity radiator, in connection with the usual fan, together with a circulating pump.

The particular points to which the makers draw attention are simplicity of construction, easy accessibility of the moving parts, and the lowness of the centre of gravity.

### THE MOTOR RAIL AND TRAM CAR COMPANY, LTD.

On the stand of the Motor Rail and Tram Car Company, Ltd., of Bedford, were several remarkably workmanlike petrol rail locomotives. None of them were entirely novel in design, but they all embodied improvements which have been lately added in order to enhance their efficiency. The engine most recently remodelled is the 10/20 B.H.P. "Simplex" locomotive, which is illustrated in Fig. BB and which was shown for the first time at the Exhibition. It weighs 2 tons and has the following overall dimensions:—Length, 8ft. 7in.; width, 4ft. 3in.; and height, 4ft. 3in.; while the wheel base is 3ft. 4in. The motive power is furnished by a four-cylinder four-stroke petrol engine having cylinders of 69 mm. and 100 mm. stroke, which develops 10 B.H.P. at 1000 r.p.m. and 20 B.H.P. at 2000 r.p.m. at sea level. Ignition is by high-tension magneto.

The change-speed gear-box, which is completely enclosed—the gear wheels running in oil—gives two speeds in each direction. The shafts are carried in ball and roller bearings. The drive is taken from the gear-box to each axle by heavy roller chains, which are capable of adjustment. The clutch is of the single-plate type. The wheels, which are of chilled cast iron, are 17½in. in diameter, and there is a screw brake which operates cast iron blocks on all four wheels. As will be seen from the illustration, the control levers and brake hand wheel are all arranged so that the driver can use them conveniently when sitting on his seat.

With the engine running normally at 1400 r.p.m. the two travelling speeds are 3·6 miles per hour on low gear and 7·2 miles per hour on top gear. These speeds can, the makers inform us, be readily increased 50 per cent. by accelerating the engine. At the lower speed, the tractive effort is given as being 1000 lb. and the locomotive is stated to be capable of hauling a load of 31 tons on the level and of 5 tons up a gradient of 1 in 20. At the higher speed the tractive effort is

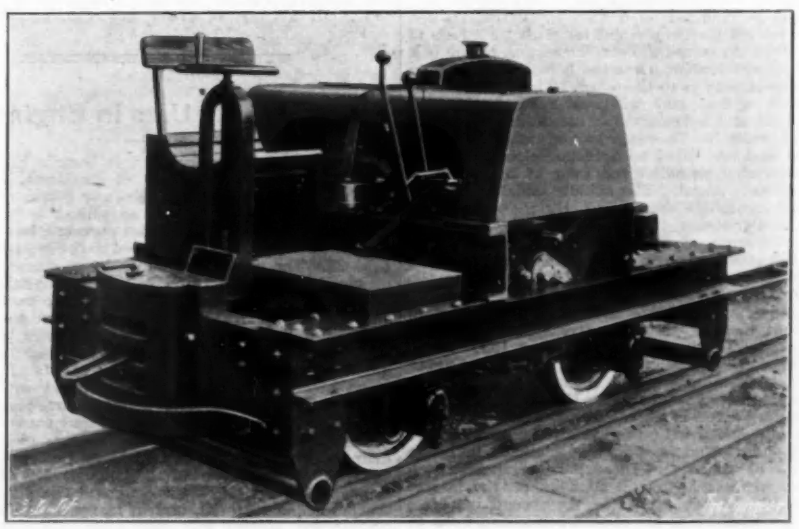


FIG. 27—10-20 B.H.P. "SIMPLEX" LOCOMOTIVE—MOTOR RAIL AND TRAM CAR COMPANY

625 lb. and 19 tons can be hauled on the level and 2½ tons on an incline of 1 in 20. The consumption of fuel is stated to be 0·68 pint per B.H.P.-hour and the petrol tank has a capacity of 10 gallons.

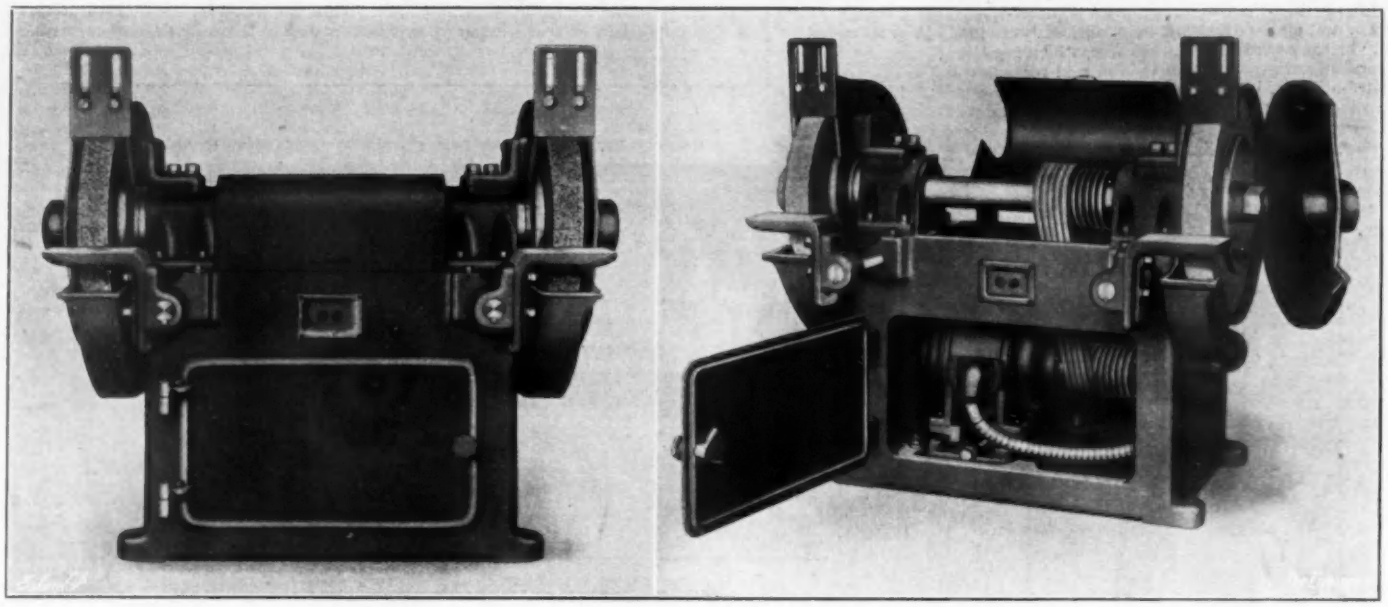
*(To be continued.)*

---

A GRAMME of pure rhenium metal has, according to the *Chemical Trades Journal*, been prepared by J. and W. Nodack from 660 kilos. of Norwegian molybdenum ore. The preparation took two months and was carried out in the tantalum factory of Siemens and Halske, at the expense of that firm. The recovery was 77 per cent. of the rhenium metal contained in the ore.

# HIGH-SPEED GRINDING MACHINE

HISEY-WOLF MACHINE COMPANY, CINCINNATI, ENGINEERS



## A High-speed American Grinding Machine.

THE machine illustrated herewith is the Hisey high-speed "snagging" grinder made by the Hisey-Wolf Machine Company, of Cincinnati, Ohio. The example illustrated is driven by a "Texrope" belt from a 10-horse-power motor in the base. The wheel, when new, has a diameter of 24in. and rotates at 1550 r.p.m., corresponding to a peripheral speed of 9500ft. per minute. When the wheel has worn to 20in. diameter, its peripheral speed is restored to the original value by changing the belt on to a second set of pulleys, which give the wheel spindle a speed of 1800 r.p.m. The machine is then operated at this speed until the wheel is worn as close as is practicable down to the flange.

The possibility has been envisaged of a full-sized wheel being fitted on the spindle in replacement of a worn wheel without the belt being shifted on to the low-speed pulleys. In such an event the new wheel would start work with a surface speed of over 11,000ft. per minute, a speed which is considered excessive. It has, therefore, been arranged that before the belt can be shifted on to the smaller pulley, the wheel guards must be moved back, as they can be by virtue of the reduced diameter of the wheels, and, conversely, before full-sized wheels can be substituted, the guards must be moved forward, the reversed action of the safety device thereupon rendering it impossible for the belt to run on the smaller pulley.

The motor is mounted on a dove-tailed sliding base and can be moved backwards and forwards by means of a screw in order to secure the correct tension in the belt and to relieve the tension when the belt is being shifted from one pair of pulleys to the other. The motor starter is enclosed in a dust and grit-proof cabinet, mounted inside the base, and is operated by means of an external push-button control. The guards are made of heavy boiler plate and are fitted with hinged doors. A chip breaker, adjustable to follow the wear of the wheel, is mounted on each guard. The spindle and the bearing housings are assembled as a unit. By the removal of four nuts at each housing, this unit can be lifted to permit the belt to be removed and a new belt substituted for it. Labyrinth seals are provided at each end of the bearing housings to prevent the ingress of dirt and grit to the spindle bearings.

The machine is also made in a single-speed design, which is built in three sizes, namely, a 10 horse-power machine to take a 24in. wheel running at 1550 r.p.m., a $7\frac{1}{2}$ horse-power size taking a 20in. wheel running at 1800 r.p.m., and a 5 horse-power machine, fitted with an 18in. wheel running at 2000 r.p.m. When the wheels are new, the surface speed in all cases is 9500ft. per minute. As a means of economising power, it is recommended that these single-speed grinders should be installed in banks of three, one of each size. In such an arrangement, a 24in. wheel, when it had worn to 20in. on the largest machine, would be transferred to the second machine, and from that machine to the third when it had worn to 18in. By this means the grinding speed would be maintained substantially constant and power would be saved by virtue of the reduced power of the motors of the smaller machines.

## RATIONALISATION.

ADDRESSING the members of the Oxford Luncheon Club on November 1st, Sir Mark Webster Jenkinson said:—

"Rationalisation is merely a milestone in industrial development which, because of economic pressure, it is desired to reach quickly instead of by easy stages and experimental methods. It is psychological because it requires a change in our mentality, in our outlook, in our business thoughts; it is physical because it requires the concentration of production in large-scale units to reduce costs; it is inevitable because it has been tried in other countries and found profitable.

"But, although it destroys that individuality in business of which this nation has been so proud, it requires of each individual responsible for management a higher standard of efficiency, a better grasp of scientific organisation, and a greater faculty for delegation before the wheels of the rationalised machine will turn smoothly.

"The danger of rationalisation is that vested interests influence, and past records will place in the topmost places those who cannot adapt themselves to the evolution of our ideas which rationalisation demands, and as rationalisation implies the concentration of management in fewer hands, even if, at the outset, the control is vested in the best men the country can supply, there is also a risk that, with the advance of years, they, in turn, will become obsolete, but will not realise that they should give place to a younger generation.

"In the interests of shareholders, and from the point of view of industry generally, it would be profitable if every public company were precluded by its articles of association from retaining as directors more than one-third in number over sixty years of age. There are exceptional men whose experience and judgment are invaluable, whose faculties for clear thinking are retained beyond sixty, and the suggested limitation to one-third would enable the company still to obtain the benefit of the accumulated knowledge and prudent direction of such who had passed the age limit.

"Company law reforms are always directed towards the protection of the unsophisticated speculator—never to the advancement of a company's earning power."

## Nickel and Its Uses in Engineering.

IN lecturing on "Nickel and its Uses in Engineering" before the Junior Institution of Engineers, Mr. W. T. Griffiths stated that prior to the war 65 per cent. of the world's production of nickel was utilised in the manufacture of nickel steel for armament purposes, but that, after the Armistice, production dropped to the level of the years 1890–91. The new uses for nickel had since that period increased the consumption to as high a figure as any attained during the war. A considerable portion of the output was used in the wireless industry for parts of wireless valves, because of its high melting point, also for the electrodes of sparking plugs. In chemical engineering, much use was made of it on account of its ability to withstand alkaline reagents. In mechanical engineering it was largely used for building up worn parts of mechanisms by electro-deposition, but its principal uses were found when alloyed with other metals. For example, in steels it increased their toughness, and in conjunction with heat treatment much improved the homogeneity of castings; in case-hardened articles it increased the penetration of the hardening material, and in many cases eliminated a preliminary heating and quenching, the extra cost of nickel being to a large extent saved by obviating a second hardening operation. In conjunction with chromium and molybdenum, large steel forgings could be made as the elastic limit of the material was much improved. That property was specially important in such structures as bridges; the Quebec Bridge was an instance. In Canada, nickel alloy steel was used in casting the bar framing of locomotives and even boiler parts, including plates. Fire-boxes and tubes were there made of an alloy steel containing 2 per cent. of nickel, which enabled the boiler pressure to be increased by some 37 per cent. without increasing the weight of the engine. Certain European railways were experimenting with the use of nickel steel for similar purposes.

When alloyed with iron, nickel had the property, when present to the extent of about 25 per cent., of destroying the magnetic properties of iron, but, strangely enough, a higher percentage of nickel restored those properties and the Western Electric Company of America had established that after heat treatment of high-content nickel-iron alloys, the magnetic qualities were ten to thirteen times better than those of the best soft iron. It also had much effect in diminishing the hysteresis loss. These properties were of much use in submarine cables, where great permeability was desirable to ensure quick working. The alloy was insulated from, but wound round the copper conductor, and prevented the interference of stray currents. An alloy of 35 per cent. nickel, 35 per cent. cobalt, and iron, known as Perminvar, showed great constancy of permeability. The addition of nickel to cast iron prevented the thin portions of castings becoming hard on cooling, and also did not open the grain of the larger portions. In heat-resisting steels it prevented corrosion of the steel up to temperatures of 600 deg. to 700 deg. Cent. Nickel-chromium alloys were now largely used for electrical heating purposes; in a large annealing furnace ribbons of the alloy arranged along the top and sides provided the heating elements.

Nickel alloyed with copper increased the tensile strength of the latter from 21 to 45 tons per square inch. It was now greatly used for condenser tubes, such tubes compared with brass having a long life without corrosion.

In the discussion following, the author stated that nearly all the nickel used in the world came from within the Empire, Canada producing 90 per cent. of it. There were also small deposits in New Caledonia.

## Canadian Engineering News.

*(From our own Correspondent.)*

### Air Line Across Canada.

THE prediction has been made by Major-General J. H. MacBrien, C.B., C.M.G., D.S.O., President of the Aviation League of Canada, that within two or three years Canada will be provided with a Trans-continental air line along which mail, express matter and passengers will be carried from coast to coast without being dependent on established aerial services in the United States. Major-General MacBrien believes aviation in the Dominion has developed so healthy a condition that thenceforth little time will elapse before all three classes demanding rapid transportation will adopt the facilities to be made available. The prairie section of the Trans-continental air line will be definitely established within a few weeks, while little time will be required to set the Maritimes–Montreal service in operation, as the Postmaster-General has promised that this will be done just as soon as adequate airports have been established at Halifax and St. John. The next section will be the lengthy route from Ottawa to Winnipeg, which has already been surveyed. The only section of the Trans-continental air line not definitely selected is that over the mountains separating Alberta from British Columbia.

### Additional Power for Montreal.

Excellent progress is being made on the new hydraulic works in the Rivière des Prairies, a short distance from Montreal. The power development, ultimately to produce 120,000 horse-power, is being conducted by the Montreal Island Power Company, the engineering, supervision and field work being done by the Power Corporation of Canada. Work is now in progress on the power-house, machinery, generators and water wheels being installed. The gates have been built, and the dam continued toward Cedar Island, a small piece of land which forms a continuation of the dam. The power-house itself is approximately 700ft. long, and forms one of the sections of the dam, extending from the north shore into the river. Then extending from the power-house to Cedar Island are thirteen sluice gates, approximately 650ft. long, and from the end of the sluice gates to Cedar Island, a distance of about 250ft., there is a concrete gravity dam approximately 35ft. high. Between Cedar and Visitation Islands, a distance of 500ft., there is a concrete non-overflow dam.

From the upstream end of Visitation Island to the south shore of the river, there is a concrete gravity type dam, and along the south shore of the river—the side nearer to Montreal Island—there is a protection wall of several thousand feet, built of concrete core with earth fill, and in certain sections steel sheet piling in the lower part with concrete core above, the outer surface being riprapped with stone.

With a flow of 27,000 cubic feet a second as the ultimate regulated flow for which the plant is designed, the normal head for flows below 35,000 c.f.s. will be from 26ft. to 27ft.; when the flood reaches 90,000 c.f.s. the head will drop to 18ft. There are being at present installed six units which will deliver a countinous output of 42,000 horse-power, with machinery installation of about 72,000 H.P., but the ultimate continuous output is estimated at 65,000 H.P., and the ultimate machinery installation will be about 120,000 H.P. There will be ten units ultimately. All turbines are equipped with adjustable blade propeller runners, adjustment being by hand when the unit is stopped, and the blade adjustment will require only a five-minute shut-down and not require unwatering of the unit.

### Saint Hubert Airport.

Steady progress is being made in the development of the Saint Hubert Airport and airship base, about seven miles from Montreal. Although it will take some years to carry out the complete plan of development, the airport, when finished, will rank as one of the most efficiently equipped airports in the world. In the meantime, facilities adequate for the traffic offering are being furnished. During the past year, the construction of permanent hangars was completed, and progress was made in grading, drainage, roads, water supply, and other necessities. Already equipment to facilitate night flying has been installed. An intermediate flood light tower, obstruction lights, and a flashing beacon have been erected so that night flying is now possible from the field. A radio station has been erected and weather reports are being received regularly.

On another part of the airdrome stands the great steel mooring tower, which places Saint Hubert among the leading airship bases in the British Empire. The tower is now virtually completed, and is in readiness for the reception of the British airship "R 100" when it makes its first Transatlantic flight. The steel tower was erected by Canadian Vickers and has been equipped with modern and efficient machinery. A silicol hydrogen gas plant has been installed, which will enable the big dirigible to replenish its gas bags, replacing any loss of the lifting medium. The mooring tower represents the outcome of negotiations undertaken at the Imperial Conference in 1926, when the construction of an airship base in Eastern Canada was promised by the Government.

## Provincial Letters.

### THE MIDLANDS AND STAFFORDSHIRE.

*(From our own Correspondent.)*

### General Conditions.

THE market tone in the Midlands and Staffordshire continues moderately bright, but increased momentum in buying of iron and steel is much needed. Generally, manufacturers are displaying considerable caution about entering into fresh commitments, the further lowering of the bank rate not having had any marked effect in restoring confidence in the future. Smelters of foundry pig iron are, possibly, the only producers who are really well placed and with whom business is maintained at a satisfactory rate. Makers of marked bars in Staffordshire probably come next, but there more orders could be executed without the necessity for working overtime. In the heavy steel branch of the market there is a shortage of orders, and some mills have not sufficient work to keep the whole of their employees regularly engaged. In the half-products department of the steel industry, foreign competition is such that local producers regularly witness orders of considerable magnitude going abroad. Galvanised sheet mills have exceedingly thin order books despite the low price now asked for supplies. Midland industries, generally speaking, are not less active than they were. Indeed, some improvement is reported in several branches of engineering and general manufacture. The works have, however, provided themselves with sufficient material to meet current needs, and consumers of iron and steel hesitate to buy forward. Dull market conditions therefore rule in Birmingham, transactions being, for the most part, for small tonnages required urgently. Now that December with the Christmas holidays and the end-of-the-year stocktaking is upon us, little substantial increase in business in iron and steel is to be expected until the New Year, and it is to that that producers are now looking. The outlook is at present hazy, and, as far as this district is concerned, it is likely to remain so until some declaration is made as to the Government's policy towards matters affecting the motor engineering industry. A very large number of trades, apart from iron and steel, are closely connected with automobile engineering, and all are affected by the prosperity or otherwise of the motor engineering establishments.

### Bar Iron.

A firm demand exists for marked bars of Staffordshire make, which sell at £12 10s. per ton. In this section of the finished iron trade works will be able to operate regularly to the end of the year. Moreover, there is every hope of securing business, in the interim, to make a successful start in the New Year possible. A somewhat firmer tendency has developed in the Crown bar branch of the market, but prices vary a good deal owing to the many varieties produced. Some of the Staffordshire works are endeavouring to make £10 7s. 6d. per ton, the standard selling figure. That price might be paid for an exceptional order for prompt delivery, but business is more generally done at a figure somewhere between £10 and £10 5s. The Black Country chain and cable trades have been slightly more active lately, but demand for common bars is small, the majority of nut and bolt makers hereabouts having substituted steel and continental iron for native material. Staffordshire bolt, nut and fencing bars are quoted £9 to £9 5s., whereas Belgian No. 3 iron bars are obtainable at £6 7s. per ton delivered into this district. Belgian and French prices are practically the same as a week ago. Active conditions continue to rule in the iron strip department. Tube works are fairly employed and are using a larger percentage of iron strip than was the case some time ago, some users of tubes having returned to the use of wrought iron tubes after a spell of steel tubes. Wrought iron tube strip maintains a strong position at £11 2s. 6d. per ton. There is no dearth of orders and supply is about equal to demand.

### Raw Iron.

A steady flow of business in foundry pig iron is maintained in the Midlands. Supply is about equal to demand, but smelters have not very much iron to dispose of when contract engagements have been fulfilled. Some Northamptonshire blast-furnacemen this week express pleasure at the manner in which contracts are being renewed. The regularity of specifications against contracts indicates steady consumption at the foundries in this area. At the forges, however, matters are not so bright, the tonnages going into consumption being relatively light. Sales continue to be made at the basis rates. Derbyshire No. 3 foundry is £3 18s. 6d.; forge, £3 14s. 6d.; Northamptonshire foundry, £3 15s.; forge, £3 11s.; North Staffordshire foundry, £3 19s. 6d.; forge, £3 15s. 6d. Furnacemen still express anxiety as to coke supplies. It is stated that up to 18s. 6d. at the ovens is being demanded, whereas three months ago supplies could be had at 15s. Some smelters feel that the advances made in the selling price of pig iron are not in keeping with the extra costs of fuel, and they would like to see a further rise in iron values in order to make pig iron production more profitable.

### Steel.

The steel market is quiet and works continue in need of orders. This now applies to billets and small bars as well as to the heavier classes of material. This week, a little more inquiry has been received from local constructional engineers, and steelmasters are hopeful of turning some of it into concrete business in the near future. Small tonnages of ship plates are also being called for; but, on the whole, the call for steel is much below normal. Minimum prices for finished steel are being quoted by all the steel works. Angles are £8 2s. 6d.; tees, £9 2s. 6d.; joists, £8 2s. 6d.; ship, bridge and tank plates, £8 17s. 6d. Boiler plates are named £9 12s. 6d. and Staffordshire hoops £10. Midland re-rollers find continental competition a serious obstacle to business. Imported bars are to be had at £6 7s. 6d. and native makers require £8 2s. 6d. as a minimum. Foreign billets this week were obtainable at £5 11s. to £5 12s. English and Welsh makers quote £6 5s. Consumptive requirements are not large, if one is to judge by the volume of business being given out whether to home or foreign makers.

### Galvanised Sheets.

The weakness of the galvanised sheet trade continues. Local works have quoted £12 15s., and even £12 12s. 6d., but without inducing much buying. On the other hand, some sellers ask as much as £13 2s. 6d. for galvanised corrugated sheets of 24 gauge. These are mills, however, which continue to be well placed and are not in urgent need of orders to keep the plant in operation. The further fall in spelter brings it to the low level of £20 1s. 3d. It has not been so cheap since some time before the war. The continued absence of orders in bulk from overseas markets makes it impossible to keep all the local mills fully employed. A reinvigoration of demand both from home and foreign sources would be very welcome just now.

### Steel Scrap.

Steel scrap is a dull market. Some of the large consumers have declined to accept further deliveries as they are already heavily stocked. Prices are weakening both as regards heavy steel and turnings. Birmingham merchants have not reduced their quotations, but many of them would be prepared to do business at a lower figure than the one quoted.

### Unemployment.

A further decline, though only a small one, is shown in the latest statistics of unemployment for the Midland area. Whereas, a week ago, the total stood at 152,894, it is now 152,613. While ten towns in the area record slight decreases, in the other twelve, which include Birmingham, increases are reported. Birmingham's unemployed now number 23,719, and Stoke-on-Trent's 14,590. Of the grand total 45,079 persons are only temporarily without work or on short time.

### LANCASHIRE.

*(From our own Correspondents.)*

MANCHESTER.

### Tubes Out of Date?

MANCHESTER'S proposed underground railway scheme is again in the limelight, and it is probable that at an early date—the January meeting has been mentioned—the City Council will be asked by the Corporation Underground Railway Committee to approach the Government on the question of a grant. In the opinion of Mr. T. Walker, the new chairman of the Committee, the scheme, the estimated cost of which is £11,000,000, is a perfectly practicable one, provided that half of the cost is contributed by the Government. Briefly, it provides for a circular route in the centre of the city, with five suburban branch lines, and is quite separate from a smaller project put forward by the Tramways Committee. Whether it will secure any great measure of support when it comes before the City Council is doubtful, for a number of adverse views, largely on the ground of expense, have been expressed during the past few days. One member of the City Council holds the opinion that the progress of civil aviation will be such that tubes will be rendered obsolete as a means of travel, and that the expenditure of about £11,000,000 on the Underground Railway Committee's scheme would be a sheer waste of money.

### Putting the Mersey Out of Sight.

The River Mersey seems to be much less appreciated at Stockport than it is at Liverpool, some 40 miles away. Stockport's dislike is based, primarily, on the fact that it occupies a good deal of what might be useful space, though æsthetic reasons, also, have something to do with the movement now afoot to roof in the river for a distance of about a quarter of a mile and at an estimated cost of between £250,000 and £300,000, where it passes through the centre of the town. Really, the scheme is a revival of one put forward, though not too seriously, about thirty years ago, and the Stockport Corporation, in a Bill to be presented to Parliament next year, is seeking powers to proceed with it. It is argued that a highway which would do much to relieve traffic congestion could be constructed along the roofed-in river, and that a new shopping centre would be created. Public opinion in Stockport is said to be strongly in favour of the scheme, although there is likely to be powerful opposition from established trading interests.

### £1,000,000 for New Road and New Bridge.

A good case in support of the projected new road running from Stretford-road, Manchester, in the south, through the Trafford Park industrial area, to Eccles New-road, Salford, in the north, including the construction of a new high-level bridge, is made out by Mr. E. L. Leeming, Engineer and Surveyor to Barton-on-Irwell Rural District Council, in a report issued this week. Between the swing-bridge over the Manchester Ship Canal at Trafford-road and the one at Barton there is no means of crossing the canal, and it is upon the Barton Bridge that the strain of congestion largely falls. Shipping traffic for the port of Manchester, *viâ* Liverpool, has to pass through Barton to reach the docks, which are situated mainly between Barton and Trafford, consequently the bridge at the former port is frequently being manœuvred to allow vessels to pass. The result is serious congestion of road traffic many times daily, and Mr. Leeming emphasises the financial loss by an interesting array of figures. Motor lorries, he points out, do not shut off their engines for the sake of 10 or 15 minutes' hold-up at the bridge, and it is estimated that the cost in petrol by blockage of traffic at Barton Bridge is £20 a day, or £7300 a year, equal to a capital sum of £146,000. The estimated loss of time for lorries is valued at £50 a day, or a capital sum of £365,000, making a total capital loss of over £500,000. These items in themselves would, on the face of it, seem to justify the estimated expenditure of £1,000,000 on the new road and bridge.

### Gas Engineering Appointment.

Manchester Corporation Gas Committee on Monday decided to reaffirm the appointment of Mr. A L. Holton, Engineer of the Bradford-road Gasworks of the Corporation, as chief engineer of the undertaking at a salary of £1500.

### Non-ferrous Metals.

Tin has been very prominent among the non-ferrous metals during the past week by reason of a recovery which has been as spectacular as the losses it has sustained since about the middle of last month. Certainly, in conjunction with the gain recorded a week ago, it has recovered virtually the whole of the ground lost since October. On balance, quotations for the metal are not much short of £10 per ton higher than they were at last report, largely owing to change in sentiment resulting from an improved statistical outlook. The total turnover has possibly been smaller, but much of the difference can be attributed to a decline in speculative activity, a fair demand being reported on account of industrial consumers. Copper, also, has continued its recovery, although in its case it has been less pronounced than in the previous week. Refined descriptions have only been in moderate request, but there has been a fair movement of standard metal in the aggregate. Further serious weakness in spelter has brought values in this section to the lowest level for about twenty years, the market being influenced by the reported ending at the close of the present year of the international agreement among producers. Offers of spelter have been particularly heavy and buyers have shown themselves not disinclined to operate at the low prices. Lead is cheaper on the week to the extent of about 10s. per ton and sales have been moderate.

### Iron and Steel.

Foundry iron is steady on this market and contract deliveries keep up fairly well, although, apart from the usual flow of contract renewals, there has been relatively little forward buying this week. For delivery in the Manchester area Staffordshire and Derbyshire irons are both quoted at 77s. per ton, with Scottish quiet at 93s. and West Coast hematite in fairly steady demand at about 90s. per ton. Bar iron remains quiet at £10 15s. per ton for Lancashire Crown quality, and £9 15s. for seconds. In steel there has been a seasonal slackening off in the demand from constructional engineering firms in this area and in certain other branches of the consuming industries, although locomotive builders are taking regular deliveries against contracts. New orders for Lancashire firms announced during the past week include one valued at about £50,000 for steel work in connection with the electrification of the Manchester-Altrincham line, secured by Edward Wood and Co.,

Manchester, and another for six locomotives, of a total value of nearly £100,000, placed with Beyer, Peacock and Co., Manchester, by the South African Railways. Steel prices are maintained at the recent range. The market for continental steel products, however, has been characterised by renewed weakness, and reductions in both semi-finished and finished materials have been announced here during the past week. The demand locally, however, has continued on a spasmodic scale, and nothing resembling general buying can be reported in this section.

BARROW-IN-FURNESS.

**Hematites.**

The position in the hematite pig iron trade of this district shows no material change. The business done has perhaps not been quite so good as of late, but still, there is a fairly good volume of trade being done with general home users, and local steel makers and iron-founders are taking deliveries of iron. Overseas requirements, for special iron, are fair. Smelters are well off for orders well into the New Year, and there is really little iron for prompt sale. There are twelve furnaces in blast.

**Iron Ore.**

For hematite iron ore there is a steady call, and the activity in the mining areas is well maintained. The trade being done is largely on the part of local smelters, but there is a demand from the East Coast and from Scotland. Importations of foreign ore are quiet at present.

**Steel.**

The position in the steel trade is not altogether satisfactory. Both at Barrow and at Workington orders are only moderately held; so far as rails are concerned, and the demand on both home and overseas account is dull. Hoops are a steady business, largely for overseas for cotton ties, &c. Castings are a fair trade.

**Shipbuilding and Engineering.**

The demand for new shipbuilding tonnage is very quiet and there is only a moderate amount of new work in hand at Barrow. In the engineering shops there is a slackening off in the gun shops because some jobs have been completed, and because of the cancellation of work for the British Government.

**Fuel.**

For coal there is a steady demand and coke is a good trade. The shipping trade is quiet. Billets have been imported into Barrow from the Continent.

## SHEFFIELD.

*(From our own Correspondent.)*

**General Trade Easier.**

ALTHOUGH this is a period of the year when the general steel trade of Sheffield and district usually shows an improving tendency, movements at present are in an opposite direction. There has recently been a quietening down of the steel trade in most of the chief centres in this country, and this state of things applies to Sheffield also, except in the special departments. The weakest spot is basic steel, which, after being well employed for a considerable time, has now tapered off substantially. The revival of foreign competition is to some extent responsible for this, but there are hopes that the difficulties in this direction may pass away, as it is reported that prices in Belgium and Germany are tending upwards. Another cause of the decline in the demand for steel for general purposes appears to be the American financial upset, which has led to a weakening of confidence. Most of the rolling mills, which prepare steel for the use of manufacturers of multifarious products, report that the volume of work is falling off. The quiet spell may be only temporary. There are authorities who believe that a buying movement throughout the steel-consuming trades is not far off, and it is thought that this will be hastened by the reduction in the Bank Rate.

**Various Departments.**

The South African Railway orders recently placed are still providing a good volume of work for a number of firms, and the requirements of the railways generally, though still far from large, are gradually increasing. The heavy forges are turning out a considerable weight of special work, and some of the steel foundries are moderately employed on various classes of castings. Several of the special branches of the steel trade are busy. This is notably the case with stainless, non-corrodible, and heat-resisting steels, the demand for which continually grows. Some firms find that it is not always easy to give prompt delivery. There is a large call for Sheffield steel from the manufacturers of electrical machinery and apparatus, and the automobile industry continues to be one of the city's leading customers for alloy steel and stamping. Activity also characterises the departments producing cold wrought steel, especially in the form of strip, the use of which continues to expand. Wire rope is not in good demand in this country, owing to the small requirements of the coal trade, but there is a good sale for it abroad, and best wire is also a brisk section. The local light iron castings works are quiet, but some other districts are making a good demand for foundry iron, with the result that supplies of Derbyshire material are well bought, and are, in fact, hardly equal to consumption.

**Skates and Stove Grates.**

The suggestion that ice rinks are likely to become exceedingly popular in this country in the near future has recently been put forward, and is of much interest to Sheffield. The city possesses two firms which for many years have been producing high-class skates on a considerable scale, and whose goods are sent to many countries. There is a need of more work in the stove grate and builders' ironwork departments. The activities of these trades are largely bound up with housing schemes, of which there are a good number on hand in the country. Since the subsidy to the building trade ceased the demand for heating appliances for villas has been poor, and, owing to keenness of competition, work has to be undertaken at low prices.

**Some Recent Contracts.**

Government orders have recently been placed with a number of firms in Sheffield and district. The Admiralty Contract and Purchase Department is buying propeller shafts from Hadfields, Ltd., Sheffield; various tools from J. Evans and Sons, Ltd., Sheffield; steel cylinders and steam pipes from the Chesterfield Tube Company. To the War Office, Stein and Atkinson, Ltd., Rotherham, are to supply an oil-fired furnace; Vickers-Armstrongs, Ltd., Sheffield, bullet-proof plates; and Snow and Co., Ltd., Sheffield, a surface grinding machine. The Air Ministry has ordered cast iron pipes from the Staveley Coal and Iron Company, Ltd. From the Crown Agents for the Colonies, Craven's Railway Carriage and Wagon Company, Sheffield, has booked an order for brake vans; Chesterfield Tube Company, steel tubes; and Henry Bessemer and Co., Sheffield, steel tires.

**Historic Works for Sale.**

Mention of Henry Bessemer and Co., reminds one that this firm has ceased to exist as an independent entity, having been absorbed by John Baker and Co., of Rotherham. As an outcome of the amalgamation the Bessemer Works in Sheffield are for sale, the business having been transferred to Kilnhurst. The works form a monument to one of the great steel inventors, having been established upwards of seventy years ago by Sir Henry Bessemer to demonstrate the commercial possibilities of his process of steel making. The vacant premises cover nearly 4 acres. The principal building is the Bessemer Steel Works, which includes a new tire mill built in 1926, forge, power-houses, offices and warehouses. A large amount of machinery is also to be offered for sale, including plant for the manufacture of axles and tires. The sale is to take place at the works on December 10th and the three following days.

**Cutlery and Plate.**

Seasonal activity in the cutlery and plate trades is still marked, and conditions are much stronger than they were during a great part of the year. The spurt will probably, however, soon begin to taper off. The output of stainless table cutlery is on a very large scale, even for such an exceptionally busy period. A steady and improving trade is maintained in goods of the best class, but the greater portion of the demand is still for the cheaper qualities. The growth of activity in the scissors branch, which has been a feature of recent months, continues. There is also a very large production of safety razor blades, though it hardly reaches the peak figures of the past.

**A Sheffield Sewerage Scheme.**

A Ministry of Health inquiry was held at Sheffield last week with regard to the application of the Corporation for power to borrow £28,629 for six sewerage schemes. The work is to be undertaken in order to relieve unemployment, and will keep 264 men employed for six months. An interesting question with regard to cost arose at the inquiry. The Inspector, being informed that the work was to be carried out by direct labour, asked how the cost would differ from contract charges, and was told that it would not be more expensive. He remarked that his experience was somewhat different from that of Sheffield. During an inquiry in Lancashire, he said, the suggestion that direct labour would be employed was made, and the City Engineer thereupon replied that he would have to alter his estimate, as the work would cost very much more. In answer to this the Deputy Town Clerk of Sheffield said if they had direct labour by a regular staff it would prove as cheap and efficient as contract work. The Sheffield Corporation had never found the cost unreasonable.

**The Scrapping of the Trams.**

Two more local authorities in this district have given notice of their intention to substitute other forms of road transport for tramcars. One is the Yorkshire and District Traction Company, which has been running tramcars in the borough of Barnsley and the urban district of Worsborough for nearly thirty years. In recent years the company has also developed a service of motor omnibuses, but has been compelled to maintain the tramway service under its Order. Now it is promoting a Bill in Parliament to authorise it to take up and remove the tram track and equipment and to substitute motor omnibuses for the cars. The other authority is the Dearne Valley Light Railway Board, on which several Urban District Councils are represented. The Board completed a tramway system shortly after the war at a cost of £250,000, and it is now proposed to abandon it and run trackless trolley venicles instead.

**Hull Level Crossings.**

The movement for the abolition of the level crossings in Hull is to be helped forward by the authorities in charge of Private Bill legislation in the House of Commons, who have arranged to give priority to the Hull Corporation Bill for building railway bridges to replace the crossings. The Government has promised a grant in aid of the work, which is one of considerable magnitude. The London and North-Eastern Railway Company announces that, in carrying out the operations for superseding the level crossings, it proposes to build within the city of Hull 4¼ miles of new railway, to alter and widen 1½ miles of existing railway, and to alter the level of 3¾ miles. Another 1½ miles of new line will be built, partly in Hull and partly in the adjoining district of Cottingham.

## NORTH OF ENGLAND.

*(From our own Correspondent.)*

**Iron and Steel Trade Outlook.**

THE outlook in the Northern iron and steel trades is regarded as distinctly encouraging, though the volume of business passing just now is on the small side. This is not at all surprising, for consumers have more or less completed their requirements up to the end of the year, and it is not likely that there will be any marked expansion of business until after the Christmas holidays. Still, there are more inquiries circulating for forward supplies than is usual at this period of the year. Consumers, no doubt, realise that the market position has become stabilised, and that prices are more likely to advance than recede. Economic conditions continue far from what could be desired, but movement towards restoration of normal profits is encouraging, though progress in that direction is still much too slow to satisfy producers of some descriptions of iron and steel. In two or three cases raw and finished materials are unsaleable, except at a loss to manufacturers, and the return of profit on the production of most types of iron and steel is very meagre.

**Cleveland Iron Trade.**

A very firm tone is maintained on the Cleveland pig iron market. Producers are disposing of the whole of their output, and not only are their stocks low, but most of the iron stored at their works is not available for sale. Merchants have now command of only very moderate quantities, and are not keen to unload their holdings at current quotations. The demand for Cleveland iron is expected to increase, and little expansion of business is needed to necessitate enlargement of output. Makers' own departments are consuming a large proportion of the make, and no difficulty is experienced in disposing of any surplus iron. Ironmasters adhere firmly to their fixed minimum figures, and continue to sell a few lots direct to home consumers, but export trade is exceedingly light. No. 1 Cleveland foundry iron is 75s.; No. 3 G.M.B., 72s. 6d.; No. 4 foundry, 71s. 6d.; and No. 4 forge, 71s.

**Hematite Pig Iron.**

The situation in the East Coast hematite pig iron trade shows little alteration on the week. Producers are quite well sold, and both home and continental consumers are still in the market for supplies. Customers, however, are showing some reluctance to pay the higher prices now demanded. On the other hand, some makers are not inclined to commit themselves, and are holding off the market until profitable prices are obtainable. Cost of hematite production is put at 80s. per ton, and for early delivery of ordinary qualities the market quotation is not more than 78s. 6d., though for delivery over the first quarter of next year nothing below 81s. is named. No. 1 quality is at a premium of 6d. per ton.

**Ironmaking Materials.**

In the foreign ore trade consumers are not placing any business just now. They have long contracts to draw against, and hope to purchase at lower figures than are at present demanded, when they come on to the market to negotiate for supplies. Sellers have very little ore to offer, and they keep quotations nominally at the level of best Rubio at 24s. 6d. c.i.f. Tees. The position as regards coke is unchanged. Producers are desirous of meeting the requirements of ironmasters, and are not taking advantage of the situation to extort exceptionally high figures. There is still a feeling that adequate supplies may be difficult to secure in the near future. The minimum price of good average qualities is 23s. 6d. delivered to works in this area.

**Manufactured Iron and Steel.**

Big outputs are being maintained in the manufactured iron and steel trade. Firms producing finished iron are well booked with orders, and semi-finished steel producers have substantial contracts to execute, but new orders are difficult to obtain, owing to the comparative cheapness of continental material, prices of which, however, are a little higher than of late. Sheets are slow of sale, particularly galvanised kinds, and revival in export business is much needed. Makers are prepared to grant price concessions to secure orders to ensure continuity of operations at the mills. So far as the heavy steel trade is concerned, plates and sections find a ready market, and constructional material is selling fairly well.

**Steel Order for Tees-side.**

Dorman, Long and Co., Ltd., Middlesbrough, have received an order for 5000 tons of steel sleepers for renewals to the main lines on the Rhodesian railways.

**More Shipbuilding Orders.**

New contracts for ships are still being secured on the North-East Coast, and the prospect for the earlier part of next year has been further improved. Sir W. G. Armstrong, Whitworth and Co., Ltd., Walker-on-Tyne, have booked an order for another vessel for Norwegian owners, and the Cowpen Shipbuilding and Dry Dock Company, Ltd., Blyth, has secured a contract for a vessel for the Burnett Steamship Company, Newcastle, to be engined by the North-Eastern Marine Engineering Company, Ltd., Wallsend. River Wear shipbuilding orders which have been booked include a cargo steamer which J. and C. Harrison, of London, have ordered from Short Brothers, with engines to be built by the North-Eastern Marine Engineering Company; two ships to be built by Messrs. Doxford for Jugo-Slav owners, and the engines by John Dickinson and Sons; a cargo steamer for Norwegian owners by Swan, Hunter and Wigham Richardson; and an oil tanker to be built by J. T. Thompson and Sons, with engines by Messrs. Dickinson. Smith's Dock Company, Ltd., of South Bank, has secured orders for a collier of 4000 tons for French owners, and two cargo steamers, each of 6700 tons, for British owners. Nothing but British

steel will be used in the construction of these vessels. It is understood that one or more of the ships will be built at the firm's newly acquired shipyard at Stockton-on-Tees.

### The Coal Trade.

The Northern coal trade presents quite a healthy tone, and active conditions are the rule at most of the collieries in both Northumberland and Durham. The demand for most descriptions continues heavy, with tonnage helping the general briskness by coming forward in adequate quantity. Several large coal tenders are pending, and there are hopes of more orders coming to the district. It is not likely that the contemplated minimum prices for coal will operate before the beginning of next April, the date when the shorter working hours in the mines are likely to be put into effect, and therefore business for the first quarter of the year is not meeting with any real hindrance. Speculators have bought from some of the collieries over the whole of next year, but customers abroad, however, are hesitating to place forward business, as they are curious to know what the minimum prices are to be, and also to learn if there is to be any subsidy on export. Some collieries experienced a strong inquiry until the Government plans were announced, and then the inquiries fell off appreciably, clearly showing the waiting policy that is being observed abroad. As a whole, the outlook is fair, and there is every prospect of steady shipments from the North-East Coast ports to the end of the year. Best Northumberland steams are marked at 17s. to 17s. 3d., and smalls are firm at 10s. 9d. to 11s. A similar tone prevails in Tyne primes, with large kinds quoted at 16s. 6d., and smalls at 14s. to 14s. 6d. Steams are the strongest section in the Durham market. Large descriptions are 18s. 6d., and smalls 14s. 6d., and these prices are readily obtainable for early positions. Merchants, however, have speculated below this basis for forward deliveries. The gas coal trade is fairly active. Best qualities are at 16s. 9d., and Wear specials at 17s. 3d. to 17s. 6d., while second gas fuel is held in a quieter way at 15s. to 15s. 3d. Coking coal is unaltered at 15s. to 15s. 9d., though up to 16s. continues nominally quoted. The bunkering trade is only moderately busy for second qualities, which remain at 14s. 6d. to 14s. 9d., but best and superior grades at 15s. 9d. to 16s. find better favour. The market for coke is well sustained, and stocks are low. Bookings forward are also comparatively abundant. Gas coke is worth 27s., but is practically unobtainable. Ordinary foundry coke is firm at 24s. 6d. to 26s., and specials are 28s. to 32s.

## SCOTLAND.

*(From our own Correspondent.)*

### Glasgow Tramways Contract.

The Transport Committee of Glasgow Corporation, at a meeting last week, unanimously agreed to recommend acceptance of an offer made by John Thompson, Ltd., Wolverhampton, for the installation of six boilers at a cost of £90,327. It is reported that one-quarter of the expenditure involved will be absorbed by local industries.

### Shipbuilding and Engineering Orders.

Orders have just been placed for two cargo steamers with Harland and Wolff on behalf of companies controlled by Lord Inchcape. These steamers will be built at Govan, one being for the Norse Line, and the other for the Hain Steamship Company, Ltd. Two important engineering contracts have been placed with John G. Kincaid and Co., Greenock. One is to provide machinery for a vessel of 7000 tons, to be built at Old Kilpatrick, and the other to supply oil engines for a vessel of 9000 tons to be built at Birkenhead.

### Ferro-Manganese and Spiegeleisen.

A reduction of £1 per ton in ferro-manganese is announced, making the price now £12 10s. for 78 per cent. delivered local works. The price of spiegeleisen has been reduced 10s. per ton, making the new quotation £7 per ton for 20 per cent. delivered local works.

### Steel.

Producers of heavy steel have practically nothing fresh to report. Outputs are comparatively good, but fresh contracts are still rather slow. Steel makers have good orders on hand for the lighter gauges, but heavy descriptions are poorly supported. Galvanised descriptions, too, are disappointing and somewhat weak in tendency. It is understood that some business in sheet has been placed on behalf of the Argentine Railways. Tube makers are still busy, but there is a distinct falling off in the amount of business on offer. Markets generally continue to suffer from the weakness of the continental position.

### Iron.

The bar iron works are very quiet and there is no indication of an early improvement. Re-rolled steel also is in a rather depressed state meantime. Continental competition is very keen, which may be judged from the disparity in prices, the continental quotation for small bars being £5 7s. 6d. f.o.b. Antwerp, compared with the home price of £7 10s. or £7 7s. 6d. per ton. Pig iron is steady, but still rather slow. Several shipments of basic iron from India and foundry iron from the Continent are reported.

### Scrap.

Prices of scrap are unchanged from last week at 72s. 6d. per ton for heavy steel and 70s. per ton for heavy basic and cast iron machinery scrap.

### Wages in the Iron Trade.

In view of the fact that the average net selling price of manufactured iron during September and October has been certified at £10 14s. 1·32d. per ton, wages of workmen will be subject to an increase of 2½ per cent. on basis rates.

### Coal.

The general demand for fuel is well maintained. Supplies for prompt shipment are, as a rule, just equal to requirements, but some descriptions of fuel are now difficult to obtain. Consequently prices are all very firm, and especially in the case of washed nuts. Lanarkshire ells and Lothians steams have improved steadily with the growth of home demands. Lanarkshire splints remain on a high level, despite a drop in the demand from certain markets, while Fifeshire steams are again in a very strong position. In all districts washed nuts show considerable strength. So far as forward business is concerned, little is being done, the collieries not being disposed to sell further ahead than three to four weeks at the most. Aggregate shipments for the past week amounted to 277,197 tons, against 304,451 tons in the preceding week, and 206,215 tons in the same week last year.

## WALES AND ADJOINING COUNTIES.

*(From our own Correspondent.)*

### Coal Trade Conditions.

There has been no new development in the anthracite or steam coal trade during the past week, though the conditions have been more unsettled and difficult by reason of tonnage being delayed by bad weather, while a recurrence of the extremely heavy rains has caused renewed flooding in various parts of the coalfield, with the consequence that the movement of coal wagons has been impeded. It is not surprising in all the circumstances that shipments of coal have been adversely affected, but as the amount of tonnage chartered of late has maintained a very good standard, it follows that when the storms abate the tonnage will come along and there should be increased activity in coal shipments. All reports show that a fair amount of loading pressure will be experienced right up to the end of the year, though the demand for large coals may not be as good as that for all other descriptions. The inquiry for large coals is still, relatively speaking, the weak spot in the steam coal section, except that the demand for the low-volatile qualities, viz., dry coals, is active. The feature of trade is the briskness of shipments to near French ports, but outside of this there is nothing of note in the market. Contract business is comparatively quiet, although tenders go in early next week for about 160,000 metric tons of locomotive coals for the Egyptian State Railways for delivery over the early part of 1930 at Alexandria.

### No Coal Stoppage.

Mr. T. Richards, the President of the Miners' Federation, lost no time in taking steps to bring about a meeting of the Coal Conciliation Board of this district for the purpose of making arrangements to consider the position in view of the fact that the wages agreement for South Wales expires at the end of the year. He communicated with Mr. Finlay Gibson, the secretary of the Coalowners' Association, last week, and as a result a special meeting of the Coal Conciliation Board was convened for Tuesday. This meeting did not last long, and no official statement was issued at the close of its deliberations, but it is stated on good authority that it was agreed, informally at least, that the present agreement would be continued until effect is given to any legislative enactments made by the Government. This will be a relief to all engaged in the coal export trade, though it was generally expected. In the meantime there is to be a meeting next Tuesday of the coalowners and another meeting of the Coal Conciliation Board will be held in about a fortnight's time.

### Effect of Storms and Floods.

There was a recurrence of very bad weather over last week-end, and the heavy rains have brought about a recurrence of floods in many parts of the coalfield. The plight of thousands of miners and their families is pitiable indeed; many of them have lost all their belongings. Thousands of pounds are needed to meet the immediate needs of the people affected, and the relief fund established so far falls short of the demands made upon it. The Pontypridd and Rhondda Councils have presented their case to the Government for substantial aid. The floods have been so heavy that work at the pits has been interrupted, as sidings have been washed away and the movement of wagons has been held up. The situation in this respect is gradually improving. It's an ill wind, however, which blows no one any good. The ship-repairing industry is much more active, for the reason that so many steamers are coming to hand in a damaged condition. The loading arrangements of most collieries are dislocated on account of the fact that many vessels cannot be put immediately at their disposal, owing to the repairs which they require. Incidentally, the notices served recently upon the joiners on account of the dispute concerning this section of labour were withdrawn about the middle of last week.

### Steel Trades and Increased Burdens.

Speaking at the annual meeting of the Swansea Metal Exchange on Tuesday, the President, Mr. Frank J. Rees, J.P., said that they viewed with not a little alarm the adoption of certain schemes by the coalowners for the marketing of their commodity. He hoped that whatever was done for the reorganisation of that great industry would not result in any increased cost of coal to the iron and steel industry. He thought, too, that they were justified in protesting against any legislative action being taken by the Government, which was bound to result in a further addition to the cost of coal, consequent upon a reduction in working hours. The state of British industry demanded, not only that they should cease further commitments in respect of social services, but that they should seriously curtail expenditure. He pointed out one direction in which more employment could be found, and remarked that it was estimated that into South Wales ports alone 80,000 tons of bars would be imported in the current year. It required but a simple calculation to show that the prohibition of these imports would result in full work being found directly or indirectly for a year of fifty weeks for over 3000 men at £3 per week.

### Tin-plate Trade.

The tone of the tin-plate market is better, owing mainly to the increase in the price of tin and a slightly improved demand. The report is current that a movement is on foot between Welsh tin-plate makers and those in France and Germany for the delimitation of markets on lines similar to those in force between Welsh and American makers. No official information is so far obtainable, it being understood that discussions proceeding have not yet reached the stage when it can be said that negotiations are definite.

### Current Business.

The tone of the steam coal market is rather irregular, so far as large coals are concerned. There is still a shortage in the demand, except for dry qualities, which are very firm and are expected to continue so for several months to come, on account of the scarcity of anthracite coals. Smalls and sized descriptions maintain a strong tone, and patent fuel makers are booked right up to the end of the year. Coke also is readily absorbed. Pitwood displays a very steady tone.

## PERSONAL AND BUSINESS ANNOUNCEMENTS.

British Brown-Boveri, Ltd., asks us to announce that on December 7th next its address will be changed from Trafalgar House, Waterloo-place, S.W. 1, to 56, Victoria-street, London, S.W. 1.

Richard Garrett and Sons, Ltd., of Leiston, ask us to announce that they have appointed Mr. Cyril M. Plane as sales engineer in connection with their electric trolley omnibus business.

H. Rofe and Son, chartered civil engineers, of 208, Abbey House, 8, Victoria-street, Westminster, S.W. 1, ask us to announce that, in future, they will carry on their practice under the style of "Rofe and Raffety." The alteration is in name only and involves no change in the constitution of the firm.

Thos. W. Ward, Ltd., of Sheffield, inform us, in connection with their recent purchase of the Ardsley Blast-furnaces and the Tingley Collieries, formerly worked by the Yorkshire Iron and Coal Company, Ltd., Leeds, that the collieries have been re-sold to a company which will continue to work the coal and find employment for many of the workmen. The blast-furnaces at Ardsley and the coke ovens and by-product plant at Tingley are being dismantled and there is now no hope of their being re-started.

## CATALOGUES.

Norton Company, Worcester, Mass., U.S.A.—"Factors Affecting Grinding Wheel Efficiency."

J. M. Henderson and Co., Ltd., King's Works, Aberdeen.—List 50–I E of cable drag scrapers.

Lunken Company, Ltd., 35, Great Dover-street, S.E. 1.—A leaflet describing the "Piccolo" hand tachometer.

J. W. and C. J. Phillips, Ltd., 23, College-hill, E.C. 4.—A catalogue of "Bristol's" recording psychrometers.

Sulzer Brothers, 31, Bedford-square, W.C. 1.—A catalogue of airless injection type R.K.W. Diesel marine engines.

Stanton Ironworks Company, Ltd., Stanton-by-Dale, Nottingham.—Monthly stock list of cast iron pipes and special castings.

Petters, Ltd., Wetland Works, Yeovil.—Publication No. 1716 of the Atomic Diesel stationary type oil engine, sizes 25 to 260 B.H.P.

W. Boby and Co., Ltd., 62, Brook-street, W. 1.—Catalogue 142B of the "Azed" water softener with illustrations of several installations.

W. A. Meyer, 75, Southwark-street, S.E. 1.—List No. T.51, relating to "E.F.A." semi-rotary wing pumps, both double and quadruple acting.

The Rushton Tractor.—In describing the Rushton agricultural and roadless tractors in last week's issue we inadvertently reversed the order of the draw-bar pulls, which should read 4500 lb. in bottom gear and 2800 lb. in intermediate gear for the agricultural model and 5100 lb. in bottom gear and 3100 lb. in intermediate gear for the roadless model.

The Institution of Chemical Engineers.—With the continual growth of keen competition, the recovery of important materials which would otherwise be wasted becomes a matter of grave concern for all industrial organisations. Apart from the commercial aspect of the matter, the discharge of many effluents, both liquid and gaseous, forms a menace to the health of both those engaged in the occupation concerned and of the community at large. Some of the problems will be discussed at the Conference on "Vapour Absorption and Adsorption," which is being held by the Institution of Chemical Engineers in the rooms of the Chemical Society, Burlington House, London, W. 1, on December 5th and 6th. Particulars of the Conference may be obtained from the hon. secretary, Institution of Chemical Engineers, Abbey House, Westminster, London, S.W. 1.

International Illumination Congress.—It has been decided that the next International Illumination Congress shall be held in Great Britain in 1931. It will be held under the auspices of the National Illumination Committee of Great Britain, in co-operation with the Illuminating Engineering Society. The Congress, which will take place during the period September 3rd to 13th, 1931, will be combined with a series of visits to places of interest in England and Scotland, so that other towns beside London will share in the work of the Congress. Papers dealing with varied aspects of lighting will be presented, and they will be grouped so as to ensure that topics of special local interest will be dealt with at each centre. The Congress will be followed by the technical meetings of the International Commission on Illumination, which will be held in Cambridge during September 13th–19th. The Honorary General Secretary of the Congress is Colonel C. H. Silvester Evans, c/o the Illuminating Engineering Society, 32, Victoria-street, London, S.W. 1, to whom all communications should be addressed.

# Current Prices for Metals and Fuels.

## IRON ORE.

| | |
|---|---|
| N.W. Coast— | |
| (1) Native | 19/6 to 22/- |
| (1) Spanish | 24/- to 26/- |
| (1) N. African | 24/- to 26/- |
| N.E. Coast— | |
| Native | 18/- to 21/- |
| Foreign (c.i.f.) | 24/9 |

## PIG IRON.

| | Home. £ s. d. | Export. £ s. d. |
|---|---|---|
| (2) Scotland— | | |
| Hematite | 4 0 0 | — |
| No. 1 Foundry | 3 18 6 | — |
| No. 3 Foundry | 3 16 0 | — |
| N.E. Coast— | | |
| Hematite Mixed Nos. | 3 18 0 | 3 18 0 |
| No. 1 | 3 18 6 | 3 18 6 |
| Cleveland— | | |
| No. 1 | 3 15 0 | 3 15 0 |
| Silicious Iron | 3 15 0 | 3 15 0 |
| No. 3 G.M.B. | 3 12 6 | 3 12 6 |
| No. 4 Foundry | 3 11 6 | 3 11 6 |
| No. 4 Forge | 3 11 0 | 3 11 0 |
| Mottled | 3 10 6 | 3 10 6 |
| White | 3 10 6 | 3 10 6 |
| Midlands— | | |
| (3) Staffs.— | (*Delivered to Station.*) | |
| All-mine (Cold Blast) | — | — |
| North Staffs. Forge | 3 15 6 | — |
| „ „ Foundry | 3 19 6 | — |
| (3) Northampton— | | |
| Foundry No. 3 | 3 15 0 | — |
| Forge | 3 11 0 | — |
| (1) Derbyshire— | | |
| No. 3 Foundry | 3 18 6 | — |
| Forge | 3 14 6 | — |
| (3) Lincolnshire— | | |
| No. 3 Foundry | 3 13 6 | — |
| No. 4 Forge | 3 9 6 | — |
| Basic | — | — |
| (4) N.W. Coast— | | |
| N. Lancs. and Cum.— | | |
| Hematite Mixed Nos. | 4 7 6 (*a*)<br>4 9 6 (*b*)<br>4 13 6 (*c*) | —<br>—<br>— |

## MANUFACTURED IRON.

| | Home. £ s. d. | Export. £ s. d. |
|---|---|---|
| Scotland— | | |
| Crown Bars | 10 5 0 | 9 15 0 |
| Best | — | — |
| N.E. Coast— | | |
| Iron Rivets | 11 10 0 | — |
| Common Bars | 10 15 0 | — |
| Best Bars | 11 5 0 | — |
| Double Best Bars | 11 15 0 | — |
| Treble Best Bars | 12 5 0 | — |
| Lancs.— | | |
| Crown Bars | 10 15 0 | — |
| Second Quality Bars | 9 15 0 | — |
| Hoops | 13 0 0 | — |
| Yorks.— | | |
| Crown Bars | 11 0 0 | — |
| Best Bars | 11 10 0 | — |
| Hoops | 12 0 0 | — |
| Midlands— | | |
| Crown Bars | 10 0 0 to 10 7 6 | — |
| Marked Bars (Staffs.) | 12 10 0 | — |
| Nut and Bolt Bars | 9 0 0 to 9 5 0 | — |
| Gas Tube Strip | 11 2 6 | — |

## STEEL. (*d*)

| | (6) Home. £ s. d. | (7) Export. £ s. d. |
|---|---|---|
| (5) Scotland— | | |
| Boiler Plates (Marine) | 10 10 0 | 10 10 0 |
| „ „ (Land) | 10 0 0 | 10 0 0 |
| Ship Plates, ¾in. and up | 8 12 6 | 7 12 6 |
| Sections | 8 2 6 | 7 2 6 |
| Steel Sheets, ¼in. | 9 0 0 | 8 15 0 |
| Sheets (Gal. Cor. 24 B.G.) | 12 17 6 | 12 17 6 |

## STEEL (*continued*).

| | Home. £ s. d. | Export. £ s. d. |
|---|---|---|
| N.E. Coast— | | |
| Ship Plates | 8 12 6 | — |
| Angles | 8 2 6 | — |
| Boiler Plates (Marine) | 10 10 0 | — |
| „ „ (Land) | 10 0 0 | — |
| Joists | 8 2 6 | — |
| Heavy Rails | 8 10 0 | — |
| Fish-plates | 12 0 0 | — |
| Channels | 10 5 0 | £9 to £9 5s. |
| Hard Billets | 8 2 6 | — |
| Soft Billets | 6 17 6 | — |
| N.W. Coast— | | |
| Barrow— | | |
| Heavy Rails | 8 10 0 | — |
| Light Rails | 8 15 0 to 9 0 0 | — |
| Billets | 6 15 0 to 9 10 0 | — |
| Manchester— | | |
| Bars (Round) | 9 2 6 | — |
| „ (Small Round) | 8 5 0 to 8 7 6 | — |
| Hoops (Baling) | 10 0 0 | 9 15 0 |
| „ (Soft Steel) | 9 0 0 | 8 15 0 |
| Plates | 8 17 6 to 9 2 6 | — |
| „ (Lancs. Boiler) | 10 0 0 | — |
| Sheffield— | | |
| Siemens Acid Billets | 9 10 0 | — |
| Hard Basic | 9 2 6 and 9 12 6 | — |
| Intermediate Basic | 7 12 6 and 8 2 6 | — |
| Soft Basic | 7 0 0 | — |
| Hoops | 9 15 0 to 10 5 0 | — |
| Soft Wire Rods | 8 2 6 | — |
| Midlands— | | |
| Small Rolled Bars | 8 2 6 to 8 15 0 | — |
| Billets and Sheet Bars | 6 5 0 to 6 12 6 | — |
| Sheets (20 W.G.) | 11 10 0 to 12 0 0 | — |
| Galv. Sheets, f.o.b. L'pool | 12 12 6 to 13 0 0 | — |
| Angles | 8 2 6 | — |
| Joists | 8 2 6 | — |
| Tees | 9 2 6 | — |
| Bridge and Tank Plates | 8 17 6 | — |
| Boiler Plates | 9 12 6 | — |

## NON-FERROUS METALS.

| | |
|---|---|
| Swansea— | |
| Tin-plates, I.C., 20 by 14 | 18/9 to 19/- |
| Block Tin (cash) | 188 10 0 |
| „ (three months) | 191 5 0 |
| Copper (cash) | 71 5 0 |
| „ (three months) | 70 5 0 |
| Spanish Lead (cash) | 21 6 3 |
| „ „ (three months) | 21 7 6 |
| Spelter (cash) | 20 5 0 |
| „ (three months) | 20 15 0 |
| Manchester— | |
| Copper, Best Selected Ingots | 78 0 0 |
| „ Electrolytic | 84 5 0 |
| „ Strong Sheets | 110 0 0 |
| „ Tubes (Basis Price), lb. | 0 1 3 |
| Brass Tubes (Basis Price), lb. | 0 1 1 |
| „ Condenser, lb. | 0 1 3 |
| Lead, English | 22 17 6 |
| „ Foreign | 21 10 0 |
| Spelter | 20 15 0 |
| Aluminium (per ton—raw ingot) | £95 |

## FERRO ALLOYS.

| | Per Ton. | Per Unit |
|---|---|---|
| Tungsten Metal Powder | 3/4½ per lb. | |
| Ferro Tungsten | 3/1½ per lb. | |
| Ferro Chrome, 4 p.c. to 6 p.c. carbon | £23 0 0 | 7/6 |
| „ „ 6 p.c. to 8 p.c. | £22 0 0 | 6/6 |
| „ „ 8 p.c. to 10 p.c. | £21 17 6 | 6/- |
| „ „ Specially refined | | |
| „ „ Max. 2 p.c. carbon | £33 0 0 | 10/- |
| „ „ „ 1 p.c. carbon | £38 0 0 | 15/- |
| „ „ „ 0·70 p.c. carbon | £39 0 0 | 15/- |
| „ „ „ carbon free | 1/2 per lb. | |
| Metallic Chromium | 2/6 per lb. | |
| Ferro Manganese (per ton) | £13 15 0 for home<br>£13 10 0 for export | |
| „ Silicon, 45 p.c. to 50 p.c. | £11 10 0 scale 5/- per unit | |
| „ „ 75 p.c. | £19 0 0 scale 7/- per unit | |
| „ Vanadium | 12/10 per lb. | |
| „ Molybdenum | 4/2 per lb. | |
| „ Titanium (carbon free) | 1/2 per lb. | |
| Nickel (per ton) | £170 to £175 | |
| Ferro Cobalt | 9/4 per lb. | |

## FUELS.

### SCOTLAND.

(*Prices not stable.*)

| | Export. |
|---|---|
| Lanarkshire— | |
| (f.o.b. Glasgow)—Steam | 14/- |
| „ „ Ell | 16/6 |
| „ „ Splint | 16/6 to 18/- |
| „ „ Trebles | 17/- |
| „ „ Doubles | 16/- to 16/6 |
| „ „ Singles | 14/- to 14/6 |
| Ayrshire— | |
| (f.o.b. Ports)—Steam | 14/6 |
| „ „ Jewel | 16/6 |
| „ „ Trebles | 17/6 |
| Fifeshire— | |
| f.o.b. Methil or Burntisland—Steam | 14/3 to 16/- |
| Screened Navigation | 18/- to 19/- |
| Trebles | 18/- to 19/6 |
| Doubles | 16/- to 17/- |
| Singles | 15/- |
| Lothians— | |
| (f.o.b. Leith)—Best Steam | 15/- |
| Secondary Steam | 14/- |
| Trebles | 17/6 |
| Doubles | 16/- |
| Singles | 14/- |

### ENGLAND.

| | |
|---|---|
| (3) N.W. Coast— | |
| Steams | 21/6 to 23/- |
| Household | 38/- to 51/- |
| Coke | 27/6 |
| Northumberland— | |
| Best Steams | 16/9 to 17/- |
| Second Steams | 15/6 to 16/- |
| Steam Smalls | 10/- to 10/6 |
| Unscreened | 13/- to 13/6 |
| Household | 25/- to 37/- |
| Durham— | |
| Best Gas | 16/6 to 16/9 |
| Second | 15/- to 15/3 |
| Household | 25/- to 37/- |
| Foundry Coke | 25/- to 30/- |

| Sheffield— | Inland. |
|---|---|
| Best Hand-picked Branch | 26/6 to 28/- — |
| Derbyshire Best Bright House | 21/- to 23/- — |
| Best House Coal | 20/6 to 21/6 — |
| Screened House Coal | 18/6 to 20/- — |
| „ „ Nuts | 16/6 to 18/- — |
| Yorkshire Hards | 15/6 to 17/- — |
| Derbyshire Hards | 15/6 to 17/- — |
| Rough Slacks | 9/- to 10/- — |
| Nutty Slacks | 7/6 to 8/6 — |
| Smalls | 3/- to 5/- — |
| Blast-furnace Coke (Inland) | 16/- to 17/- on rail at ovens |
| Furnace and Foundry Coke (Export), f.o.b. | 23/- to 24/- |

### (9) SOUTH WALES.

| | |
|---|---|
| Cardiff— | |
| Steam Coals: | |
| Best Smokeless Large | 20/- to 20/3 |
| Second Smokeless Large | 18/9 to 20/- |
| Best Dry Large | 19/6 to 21/- |
| Ordinary Dry Large | 19/- to 19/6 |
| Best Black Vein Large | 18/3 to 18/6 |
| Western Valley Large | 17/9 to 18/- |
| Best Eastern Valley Large | 17/9 to 18/3 |
| Ordinary Eastern Valley Large | 17/6 to 17/9 |
| Best Steam Smalls | 14/3 to 14/6 |
| Ordinary Smalls | 13/- to 14/- |
| Washed Nuts | 19/6 to 22/6 |
| No. 3 Rhondda Large | 20/3 to 21/- |
| „ „ Small | 15/6 to 16/- |
| No. 2 „ Large | 17/3 to 17/6 |
| „ „ Through | 15/6 to 16/6 |
| „ „ Smalls | 14/3 to 14/9 |
| Foundry Coke (Export) | 32/6 to 37/6 |
| Furnace Coke (Export) | 30/- to 31/- |
| Patent Fuel | 22/- to 22/6 |
| Pitwood (ex ship) | 28/9 to 29/3 |
| Swansea— | |
| Anthracite Coals: | |
| Best Big Vein Large | 35/- to 37/6 |
| Seconds | 28/6 to 30/6 |
| Red Vein | 24/- to 27/6 |
| Machine-made Cobbles | 42/- to 45/- |
| Nuts | 42/6 to 45/- |
| Beans | 25/- to 27/- |
| Peas | 18/9 to 19/3 |
| Breaker Duff | 10/3 to 10/6 |
| Rubbly Culm | 13/3 to 13/9 |
| Steam Coals: | |
| Large | 18/- to 19/- |
| Seconds | 17/- to 18/- |
| Smalls | 12/- to 13/9 |
| Cargo Through | 15/6 to 16/6 |

(1) Delivered. (2) Net Makers' Works. (3) f.o.b. Makers' Works, approximate. (4) Delivered Sheffield. (5) Glasgow, Lanarkshire and Ayrshire. (6) Home Prices—All delivered Glasgow Station. (7) Export Prices—f.o.b. Glasgow. (8) Except where otherwise indicated, coals are per ton at pit for inland and f.o.b. for export, and coke is per ton on rail at ovens and f.o.b. for export. (9) Per ton f.o.b. (*a*) Delivered Glasgow. (*b*) Delivered Sheffield. (*c*) Delivered Birmingham. (*d*) Rebate: Joists (minimum), 12/6; Ordinary Ship, Bridge and Tank Plates and Sections, 10/- if home consumers confine purchases from associated British Steel Makers.

# French Engineering Notes.

*(From our Correspondent in Paris.)*

### The Trade Situation.

In the engineering trades there continues to be plenty of employment on account mainly of the public works that are being carried out all over the country, while the wagon-building shops have so many orders in hand that trouble is being experienced with the labour scarcity. Nevertheless, there has been a slowing down of activity in many departments, especially in the motor car trade, and the situation is dominated by the weakness of the steel trade all over the Continent. Everywhere there is a diminishing consumption, which, it is feared, will affect all branches of industry, though it is hoped to prevent it from extending to France by pushing forward public undertakings in the coming year. A considerable sum of money is being devoted to this purpose. The steel trade abroad is becoming more and more disorganised through over-production and the difficulty of maintaining prices. It appears impossible that prices can go lower. Colliery owners have advanced prices to cover the higher wages, and coke and pig iron are showing a firmness that leaves no doubt that any further move will be in an upward direction. At the rolling mills there is the same trouble with higher wages and production costs, and in Belgium some firms declare that despite a greater turnover they have made less profit. So much Belgian steel is being offered in France that the situation of home producers can, it is declared, only be saved by advancing the import duties on that material. Under the Cartel arrangement, Germany is not supposed to export steel to this country, apart from what is required for reparations, but, nevertheless, German firms are offering sheets, strip and special steels on very favourable terms. As a matter of fact, France is the only country in which there is any considerable industrial activity, and steel producers elsewhere are looking to this market. Therefore, the Executive Committee of the Steel Cartel is credited with the intention of recommending another reduction of steel output.

### Merchant Shipping.

Although there continue to be complaints that the merchant marine is labouring under all sorts of disabilities and finds it difficult to compete for foreign freights, the situation is, nevertheless, by no means unsatisfactory. The eight hours' working day, which cannot be applied in its entirety, is a serious obstacle, but the shipping companies possess a monopoly of the growing colonial traffic, and some of them are subsidised by the State. There is no diminution of the tonnage in service, but the renewal of the fleet is not carried out as extensively as is desired by shipbuilders, or by those who fear that French merchant shipping is falling behind that of other countries which are building more economical ships with larger cargo space. Therefore, the new Minister of Mercantile Marine has given publicity to his programme for placing the marine on a more satisfactory basis and for providing work to home shipbuilders. He declares that French shipowners must be able to purchase their vessels at the same price as those abroad. Apparently, he aims at an extension of the facilities offered by the Credit Maritime in the hope that shipowners will place orders at home for vessels which will enable them to compete for foreign freights. So far, the attempts to divert business to French shipyards have not been uniformly successful. There has been too great an increase in the shipbuilding capacity during the past decade, and nearly all the yards are situated at too great a distance from the sources of raw material supply to allow of cheap production.

### Railway Electrification.

The electrification of the line between Culoz and Modane on the P.L.M. Railway system is now practically completed. The line is quite level from Culoz to Saint-Pierre-d'Albigny, but from there it continues on an up gradient of 3 per cent. The contact is by third rail, except through the principal stations, the current being supplied by private hydro-electric companies at 45,000 volts and transformed to 1500 volts for traction. There are six electric locomotives of different types now running experimentally, three for express service and three for goods trains. This is the first stage of the P.L.M. electrification scheme, which will be continued by the electrification of the Lyons–Grenoble–Vagnes–Marseilles and Lyons–Geneva railways and along the Riviera, but as the policy of the company is to undertake the work at its own convenience, when circumstances are most favourable, it is expected that the execution of this programme will be spread over a considerable period.

### Rural Water Supply.

The plans being carried out for reviving the prosperity of rural districts, which have long suffered from a continuous depopulation, involve the execution of a vast system of works, and one of the most urgent is the provision of an adequate water supply all over the country. While, in most cases, the supply is deficient and of indifferent quality, in others there is a complete dearth of water during the dry seasons. The State has organised a technical service in order to aid the communes to make the most of their water supplies, particularly in the way of laying out installations, and the Government has now decided to provide credits up to 500 million francs to be extended over a period of five years for the supply of water to rural populations.

### A Seaplane Station.

Arrangements are being made to create a seaplane station at Tripoli in Syria, where the situation is regarded as particularly favourable for the traffic between Western Europe and the East. As a port for commercial seaplanes, it is stated to possess special advantages. The French Government has decided to carry out a complete installation, including the construction of a wharf 1000 m. long, the total cost involved being about 15 million francs. Tenders for the work will be invited at Beirut at an early date.

# British Patent Specifications.

*When an invention is communicated from abroad the name and address of the communicator are printed in italics.*

*When an abridgment is not illustrated the Specification is without drawings.*

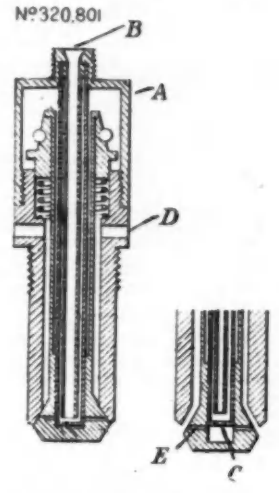
*Copies of Specifications may be obtained at the Patent Office Sale Branch, 25, Southampton-buildings, Chancery-lane, W.C., at 1s. each.*

*The date first given is the date of application; the second date, at the end of the abridgment, is the date of the acceptance of the complete Specification.*

### INTERNAL COMBUSTION ENGINES.

320,801. November 20th, 1928.—Fuel Sprays, L. H. L. Bellem, 34, rue de Chateaudun, Asnières, Seine, France, and E. C. Foss, 5, rue du Lieutenant Boncour, Neuilly-sur-Seine, France.

In this fuel-spraying valve, the atomising effect is produced by a draught of air caused by the suction of the engine piston. The valve stem, it will be seen, is hollow and contains two tubes. The outer tube is a sliding fit in the bore, and is fixed to the cap

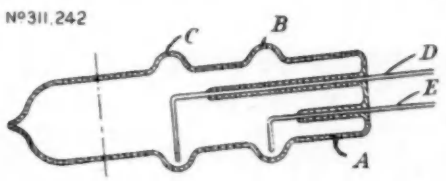



A. The fuel oil is supplied by the inner pipe B. The end of the outer tube has a calibrated orifice C for the passage of the oil. In action, as the valve starts to open, air is sucked in through the openings D and down round the outside of the valve stem. The end of the outer tube then uncovers the ports E and the oil flows out on to the seating, to be atomised by the passing air.—*October 24th*, 1929.

### SWITCHGEAR.

311,242. May 7th, 1929.—Mercury Electric Switches, Dr. Paul Meyer Aktiengesellschaft, of Lynarstrasse 5/6, Berlin N. 39, Germany.

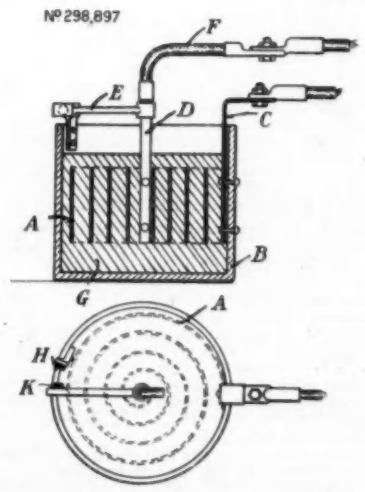
This specification describes a new form of tilting mercury electric switch tube, claimed to offer many advantages. A is the switch tube and B and C are two swellings. D and E are the two electrodes which are introduced into the swellings




above the surface of the mercury and run along in a somewhat circular-shaped curve in the swelling. When the tube is tilted, that portion of the mercury which must flow in a direction from electrode E to electrode D is not hindered in any way in its mobility by the electrodes D and E; but in spite of this, a very long length of the electrodes is in contact with the mercury.—*October 24th*, 1929.

298,897. October 9th, 1928.—Electric Switch Operating Devices, International General Electric Company, of 120, Broadway, New York.

In accordance with this invention, the bi-metallic strip A

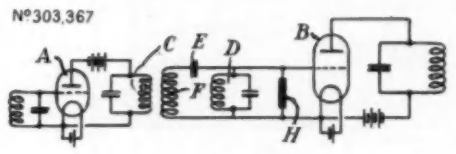



is in the form of a spiral, one end of which is secured to the wall of an electrically insulating vessel B and has a connecting strip C bent upwards and projecting out of the vessel. The inner end of the spiral is connected with the axis D, which carries a contact arm E and serves for the connection of the flexible lead F. The spiral A is surrounded by a mass G on all sides. If the current traversing the spiral A increases to an inadmissible value, it heats the strip A and mass G surrounding it. After a certain time the mass will become heated and soft to such an extent that the spiral can execute a turning movement and move the axis D and the contact arm E and finally bring into connection the contacts H and K. In the cold condition the spiral A is firmly held by the mass, so that it is unable to carry out any movement or vibration. The time of response can be adjusted as desired by the selection of the capacity for heat or the quantity of the embedding mass. Further possibilities of adjustment are also afforded by selection of the dimensions for the bi-metallic strip.—*October 24th*, 1929.

### TELEGRAPHS AND TELEPHONES.

303,367. December 29th, 1928.—Thermionic Valve Transmitters, Telefunken Gesellschaft für drahtlose Telegraphie m.b.H., of 12/13, Hallesches, Ufer, Berlin, Germany.

This invention relates to circuit arrangements suitable for use in thermionic valve transmitters and more particularly to an improved grid circuit arrangement for a so-called "distant controlled" transmitter valve. In the drawing A represents a generator valve and B a distant controlled valve. The working

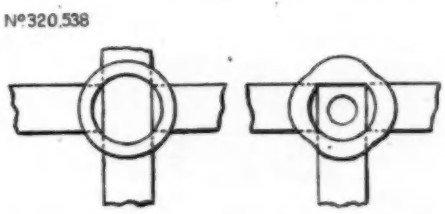



circuit C of the valve A operates upon the grid circuit of the valve B. The last circuit consists of a parallel-connected oscillating circuit D tuned to the working frequency and a series-connected resonant circuit constituted by a capacity E and an inductance F. In some circuits for wireless telephony it is advisable to connect a damping resistance H in parallel with the oscillating circuit D in order to avoid too sharp a resonance curve for the grid circuit and thus to allow a reasonably wide frequency band to be dealt with.—*October 24th*, 1929.

### BUILDING.

320,538. October 29th, 1928.—Welding by means of the Autogenous Process, W. R. Hume, Kinnear House, corner of King and Little Collins streets, Melbourne, Victoria.

The inventor suggests that in the manufacture of wire fences and such-like structures by autogenous welding at the joints

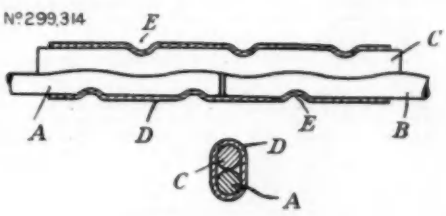



of the various members, an unsightly job may be produced. He thus proposes to use what might be described as a curb round the junction to be welded, with the object of defining the shape of the weld. The curb may be of copper, in order to chill the weld as it is made, and be subsequently removed, or may be of a metal similar to that being worked upon and welded into the joint.—*October 17th*, 1929.

### MISCELLANEOUS.

299,314. October 20th, 1928.—Connecting Means for Electric Conductors of Aluminium or Aluminium Alloy, Siemens-Schuckertwerke Aktiengesellschaft, of Berlin-Siemensstadt, Germany.

With aluminium conductors the making of perfect electrical connection presents difficulty, and, according to this invention, the various troubles met with, which are set forth in this



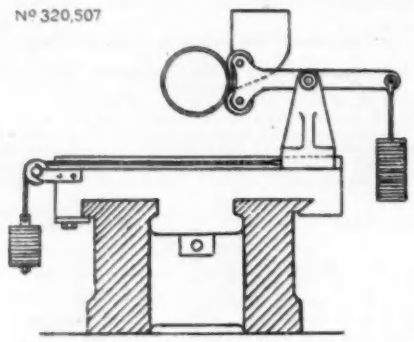

specification are avoided. In the drawing A and B are the ends of an aluminium magnesium alloy in the form of round wires that have to be formed together. C is an auxiliary wire of pure aluminium or of an aluminium magnesium alloy, which covers the joint of the two wires A and B. Whilst D is an oval sleeve, also composed of aluminium or an aluminium alloy, which is forced over the welded joint and auxiliary wire and clamped in the well-known manner by notches E.—*October 17th*, 1929.

320,507. September 24th, 1928.—Coating Pipes with Non-corrosive Material, Stewarts and Lloyds, Ltd., 41, Oswald-street, Glasgow, J. Mitchell, Marell, Bowling Green-street, Coatbridge, and J. H. Smith, Clyde-street, Coatbridge.

According to this present invention, pipes are coated externally by feeding the coating material in the consistency of a mastic on to the pipe, which is in rotation, in such a way that the coating material is continuously built up as a mass on the pipe, and the mass is continuously pressed down, spread, and smoothed over to form a seamless covering. The coating material must be such that it can be brought to a dough-like consistency, not sufficiently liquid to run, but capable of being spread by mechanical means on the pipe surface, which may be heated before coating or painted with a bituminous paint to improve adhesion. The pipe to be lined is supported in a lathe, as shown in the drawing, having in conjunction with it a hopper from which the coating material is fed, this hopper being constituted by a tank having internal stirring means and means for heating its contents, whilst its lower or discharge end and sides are continued as a scoop. The edge of this scoop is parallel with the surface of the pipe for a portion of its length, and recedes from the pipe for the remainder of its length. As the hopper travels longitudinally along the pipe feeding out the coating material, the

receding edge of the scoop precedes the part of the edge which is parallel with the pipe. The hopper is charged with coating material, usually a bituminous substance or coal tar pitch mixed with asbestos wool or other fibre and brought to the consistency of dough. In most cases, the inventor prefers to use a composition consisting of 80 per cent. by weight of bitumen and 20 per cent. by weight of asbestos wool at a temperature of about 400 deg. to 450 deg. Fah. After having been heated and painted with bituminous paint, the pipe is rotated while the hopper moves along its length, feeding the doughy material on to the pipe. The receding part of the scoop below the orifice allows the coating material to be built up as a thick mass, whereafter it is pressed down and smoothed out by the remaining

Nº 320,507

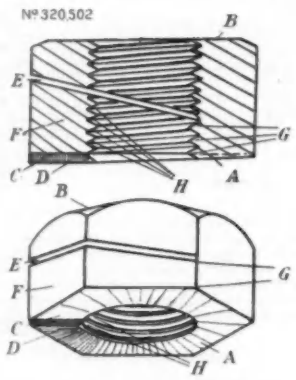


part of the side of the scoop, which is shaped for this purpose. The result is that the pipe is covered with the composition to a thickness determined by the adjustment of the scoop relative to the pipe and the covering is free from seams. When coating long pipes—say, about 30ft. in length—the pipe may tend to whip in the turning machine, so that, with a hopper directly mounted on the traversing mechanism, the coating would be uneven; consequently, the hopper is pivoted and provided with a resilient mounting on the traversing mechanism. To the hopper is attached a gauge wheel or wheels contacting with the pipe, by means of which the hopper is maintained at an approximately constant distance from the pipe.—*September 17th*, 1929.

320,502. May 18th, 1929.—Lock Nuts, A. F. Holt, 35, Coombe-road, Gravesend, Kent, and H. A. Holt, 24, Cross-lane, East, Gravesend.

This lock nut is described in the specification as follows:—"A hexagon nut is provided, the lower face A is chamfered across the nut and in the opposite direction to the threads of the nut this forms a helix from the base C to the apex D. The

Nº 320,502

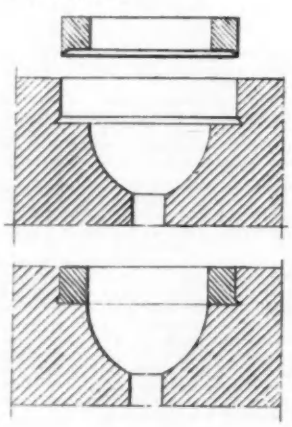



termination forms a tooth or ratchet-like piece. Between the lower and upper faces a slot is cut or milled at two-thirds of the depth sloping to one-third, and terminating at the other side of the threaded bore. This forms a wedge-shaped piece F, but still attached to body of the nut. Consequently, when the nut is tightened, not only is the piece F caused to bind on the bolt, but the ratchet-like tooth D is fixed into the seat of the nut, causing an additional locking effect."—*October 17th*, 1929.

320,830. January 25th, 1929.—Valve Seats for Internal Combustion Engines, H. Andrews and A. Andrews, 312, Bradford-street, Birmingham.

It appears that the inventors aim at the provision of a renewable seating for the poppet valves of internal combustion engines, but the method of renewal is not explained, although the process of introduction of the primary seating is plainly

Nº 320,830



disclosed. The seating, it is said, may be of cast iron, and has at its lower edge a lip, which is extruded into an undercut groove when this ring is forced down into the main casting. It will be observed that the lip is forced outward so as to key into the casting. The process of introducing the ring is plainly shown in the two drawings.—*October 24th*, 1929.

# Forthcoming Engagements.

*Secretaries of Institutions, Societies, &c., desirous of having notices of meetings inserted in this column, are requested to note that, in order to make sure of its insertion, the necessary information should reach this office on, or before, the morning of the Wednesday of the week preceding the meetings. In all cases the* TIME *and* PLACE *at which the meeting is to be held should be clearly stated.*

## TO-DAY.

Institution of Automobile Engineers: Scottish Graduates.—Regent Restaurant, 51, West Regent-street, Glasgow. "Two-stroke Engines: Some Experiments on a New Type," by Mr. J. W. Robertson. 8 p.m.

Institute of Marine Engineers.—At the Hotel Victoria, Northumberland-avenue, W.C. 2. Annual conversazione. Reception, 7 to 7.30 p.m.

Institution of Mechanical Engineers.—Storey's-gate, St. James's Park, London, S.W. 1. Extra general meeting. An open debate on "The Registration of Reliable Tests of Power Plant Machinery," to be introduced by Mr. R. H. Parsons. 6 p.m.

Junior Institution of Engineers.—39, Victoria-street, S.W. 1. Informal meeting. Lecture, "Modern Welding Systems and Applications," by Mr. W. C. Freeman. 7.30 p.m.

Keighley Association of Engineers.—Queen's Hotel, Keighley. Ladies' night. "A Tour through Central Europe," by Mr. L. Hutton. 7.30 p.m.

## SATURDAY, NOVEMBER 30TH.

Institute of Metals: Birmingham Local Section.—Queen's Hotel, Birmingham. Fourth annual dinner and ladies' night.

North of England Institute of Mining and Mechanical Engineers: Associates' and Students' Section.—Lecture Theatre, Neville Hall, Newcastle-upon-Tyne. The following paper will be open for further discussion, "Machine Mining in Faulted Ground," by Mr. Alan L. Ford; the following paper will be read, "A Few Notes on Miners' Nystagmus," by Mr. Frank Y. Pattern. 3 p.m.

## MONDAY, DECEMBER 2ND.

Bradford Engineering Society.—Technical College, Bradford. "Boiler-house Instruments and their Use," by Mr. S. N. Duguid. 7.30 p.m.

Institution of Automobile Engineers: Loughborough Graduates.—The College, Loughborough. "Carburettors and Carburation," by Mr. H. G. Nicoll. 7 p.m.

Institution of Automobile Engineers: Western Centre.—Merchant Venturers' Technical College, Bristol. "The Relative Safety of Mild and High Tensile Steel Under Alternating and Pulsating Stresses," by Dr. B. P. Haigh. 6.45 p.m.

Institution of Electrical Engineers: South Midland Centre.—At the University, Edmund-street, Birmingham. "The Modern Use of Pulverised Fuel in Power Stations," by Mr. R. A. Chattock. 7 p.m.

Royal Institution of Great Britain.—21, Albemarle-street, W. 1. General meeting. 5 p.m.

Royal Society of Arts.—John-street, Adelphi, W.C. 2. Cantor Lecture, "Musical and Scientific Aspects of Wind Instruments." Lecture III., effect of the shape, material and "scale" of the pipe; the modern flute; the clarinet, oboe and allied reed instruments; brass instruments with pistons; the trombone, by Dr. E. G. Richardson. 8 p.m.

Society of Engineers.—In the Apartments of the Geological Society, Burlington House, W. "Some Points in Reinforced Concrete Bridge Design," by Mr. C. S. Chettoe. 6 p.m.

Wolverhampton and District Engineering Society.—Victoria Hotel, Wolverhampton. "Water Power Development," by Mr. T. Smith. 7.30 p.m.

Women's Engineering Society.—41, Cadogan-square, S.W. 1. "Powdered Fuel," by Capt. J. C. Brand. 6.15 p.m.

## TUESDAY, DECEMBER 3RD.

Institution of Automobile Engineers.—At the Royal Society of Arts, John-street, Adelphi, W.C. 2. "Aluminium Alloys from the User's Point of View," by Mr. J. B. Hoblyn. 7.45 p.m.

Institution of Automobile Engineers: Coventry Graduates.—Broadgate Café, Coventry. "Commercial Vehicle Engines," by Mr. P. Wheeler. 7.15 p.m.

Institution of Civil Engineers.—Great George-street, Westminster, S.W. 1. Papers to be submitted for discussion:—"H.M. Dockyard, Devonport: Widening of No. 5 Basin Entrance," by Mr. George Stephen Jacob; "The Reconstruction of a Graving Dock Entrance with a Single-leaf Gate at Hebburn-on-Tyne," by Mr. James Mitchell. 6 p.m.

Institution of Electrical Engineers: North-Eastern Centre.—At the Central Station Hotel, Newcastle-on-Tyne. Annual dinner and reunion. Reception, 7 p.m.; dinner, 7.15 p.m.; reunion, 9.30 p.m.

Institution of Electrical Engineers: North Midland Students' Section.—Hotel Metropole, Leeds. "The Oil Circuit Breaker," by Mr. C. S. T. Paul. 7.20 p.m.

Institution of Electrical Engineers: Scottish Centre.—North British Station Hotel, Edinburgh. "Engineering from the Cape to Cairo," by Professor F. G. Baily. 7 p.m.

Institution of Engineers-in-Charge.—Joint meeting with the Association of Supervising Electrical Engineers, Magnet House, Kingsway, W.C. 2. "Development of Lighting Accessories," by Mr. F. G. Quance. 7.15 p.m.

## WEDNESDAY, DECEMBER 4TH.

Institution of Automobile Engineers.—Metropole Hotel, King-street, Leeds. "The Pneumatic Tire in Heavy Transport," by Mr. A. Healey. 7.30 p.m.

Institute of Metals: Swansea Local Section.—In Thomas's Café, High-street, Swansea. "Coke Carbonisation and By-products," by Mr. G. Crift. 7 p.m.

Institution of Civil Engineers.—Great George-street, Westminster, S.W. 1. Students' Meeting. "Well Boring," by Mr. H. A. P. Hetherington. 6.30 p.m.

Institution of Electrical Engineers: Wireless Section.—Savoy-place, Victoria Embankment, W.C. 2. "Naval Wireless Telegraphy Communications," by Mr. G. Shearing and Capt. J. W. S. Dorling, R.N. 6 p.m.

North-East Coast Institution of Engineers and Shipbuilders: Graduate Section.—Bolbec Hall, Newcastle-on-Tyne. "Pulverised Fuel: Past and Present," by Mr. R. Munton. 7.15 p.m.

Royal Society of Arts.—John-street, Adelphi, W.C. 2. "The Advertiser and the Disfigurement of Town and Country-side: Criticisms and Suggestions," by Mr. H. H. Peach. 8 p.m.

## THURSDAY, DECEMBER 5TH.

Institution of Electrical Engineers.—Savoy-place, Victoria Embankment, W.C. 2. "Surges and Over-voltage Phenomena on Transmission Lines Due to Lightning and Switchgear Disturbances," by Dr. H. Norinder. 6 p.m.

Royal Aeronautical Society: Postponed Lecture.—The lecture by Senr. de la Cierva on "Recent Work on the Autogiro," originally fixed for December 5th next, has been unavoidably postponed. The lecture will be delivered by Senr. de la Cierva in the second half of the present Session.

## THURSDAY AND FRIDAY, DECEMBER 5TH AND 6TH.

Institution of Chemical Engineers.—Conference on Vapour Absorption and Adsorption, to be held in the Rooms of the Chemical Society, Burlington House, Piccadilly, London, W. 1. Thursday, 10.30 a.m., papers: "The Reversibility of the Adsorption Process and the Thickness of the Adsorption Layer," by Professor J. C. Philip, F.R.S.; "The Recovery of Acetone Vapours from the Air," by Dr. W. R. Ormandy; discussion. 2.30 p.m., papers: "The Recovery of Benzol from Coal Gas, with Special Reference to the Use of Activated Carbon," by Mr. H. Hollings, Dr. S. Pexton, and Dr. R. Chaplin; "The Absorption of Nitrous Gases," by Mr. Harry W. Webb; discussion. Friday, 10.30 a.m., papers: "The Recovery of Volatile Solvents (Brégeat Process)," by Mr. A. Hoch; "The Continuous Fractionation of Gases by Adsorbents," by Mr. J. Stanley Morgan; discussion. 2.30 p.m., papers: "Evaporation of Water in Open Pans," by Mr. G. W. Himus; "The Industrial Application of Active Carbon," by Mr. K. Evans, A.R.C.S., and Mr. H. F. Pearson; discussion.

## FRIDAY, DECEMBER 6TH.

Institution of Electrical Engineers: Meter and Instrument Section.—Savoy-place, Victoria Embankment, London, W.C. 2. "Alternating-current Potentiometers and their Applications," by Dr. C. V. Drysdale. 7 p.m.

Institution of Locomotive Engineers, London.—At the Manchester Literary and Philosophical Society, 36, George-street, Manchester. "Pulverised Fuel Locomotives," by Mr. J. W. Clubley Armstrong. 7 p.m.

Institution of Water Engineers.—Thirty-fourth Winter General Meeting, Session 1929–30. At the Institution of Civil Engineers, Great George-street, Westminster, S.W. 1. The following papers will be taken as read, after which discussion will take place: "The Hydro-geology of the Chalk of England," by Mr. R. C. S. Walters; "Some Problems in Hydro-geology," by Professor Edgar Morton. The following Reports of the Advisory Committee on Water of the Ministry of Health will be brought before the meeting for general discussion: "Second Report of the Legislation Sub-Committee," discussion to be opened by Mr. R. J. Simpson; "Report on Rural Water Supplies," discussion to be opened by Mr. E. J. Silcock. The following Draft Report of a Sub-Committee of the Council will be brought before the meeting for consideration: "Stream Flow and Underground Water Records." 10.30 a.m.

Junior Institution of Engineers.—39, Victoria-street, S.W. 1. "The Demolition of Lambeth Bridge," by Mr. A. B. Gowring. 7.30 p.m.

North-East Coast Institution of Engineers and Shipbuilders.—Bolbec Hall, Newcastle-on-Tyne. "Cutting Capabilities of Lathe Tools," by Professor Dempster Smith. 6 p.m.

Royal Institution of Great Britain.—21, Albemarle-street, W. 1. Discourse, "The Novel and the Creative Spirit," by Mr. Hugh Walpole. 9 p.m.

## SATURDAY, DECEMBER 7TH.

Institution of Municipal and County Engineers.—South-Western District meeting to be held at Exeter. "The Local Government Act, 1929," address by Lieut.-Col. E. J. Stead. To be followed by a discussion. 3 p.m.

## MONDAY, DECEMBER 9TH.

Institute of Metals: Scottish Local Section.—In the Rooms of the Institution of Engineers and Shipbuilders in Scotland, 39, Elmbank-crescent, Glasgow. "Melting Furnaces," by Mr. G. L. Cassidy. 7.30 p.m.

## TUESDAY, DECEMBER 10TH.

Institute of Metals: North-East Coast Local Section.—In the Electrical Engineering Lecture Theatre, Armstrong College, Newcastle-on-Tyne. "Nickel in Non-ferrous Foundry Alloys," by Mr. W. T. Griffiths. 7.30 p.m.

Institution of Automobile Engineers.—King's Head Hotel, Coventry. "The Relative Safety of Mild and High-tensile Steel Under Alternating and Pulsating Stresses," by Dr. B. P. Haigh. 7.30 p.m.

## WEDNESDAY, DECEMBER 11TH.

Institution of Civil Engineers.—Great George-street, Westminster, S.W. 1. Informal Meeting. Subject for discussion:—"The Heating of Buildings by Electricity off Supply Mains, with special reference to the Problem of Heat-Storage and Off-peak Loads," by Mr. Arthur Henry Barker. 6 p.m.

Institution of Municipal and County Engineers.—Northern Ireland District meeting at the Municipal College of Technology, Belfast. A paper and discussion on "Town Planning," by Mr. R. B. Donald. 6.45 p.m.

Royal Society of Arts.—John-street, Adelphi, W.C. 2. "Overheads and other Factors Influencing Road Transport Costs from an Engineer's Viewpoint," by Major Charles Wheeler. 8 p.m.

## THURSDAY, DECEMBER 12TH.

Institute of Marine Engineers: Junior Section.—85–88, The Minories, E.C. 3. An informal meeting of student graduates and graduates, "What is Expected of a Junior Engineer on Joining his First Ship," by Mr. J. R. Douglas. 6.30 p.m.

Institute of Metals: Birmingham Local Section.—In the Chamber of Commerce, New-street, Birmingham. "Die Casting," by Mr. A. H. Mundey. This paper forms part of a joint programme arranged by the Birmingham Metallurgical Society, the Staffordshire Iron and Steel Institute, and the Birmingham Local Section of the Institute of Metals. 7 p.m.

Institute of Metals: London Local Section.—Joint meeting with the Institute of British Foundrymen, in the Rooms of the Society of Motor Manufacturers and Traders, Ltd., 83, Pall Mall, S.W. 1. "Metal Melting by Electricity," by Mr. D. F. Campbell and Mr. W. S. Gifford. 7.30 p.m.

Institute of Patentees.—Caxton Hall, Westminster, S.W. 1. "Inventions as an Aid to Health," by Sir Wm. A. Lane, Bart. 8 p.m.

Institution of Automobile Engineers.—Joint meeting with the Institution of the Rubber Industry, Grand Hotel, Birmingham. "The Mechanical Properties of Rubber," by Mr. A. Healey. 7.30 p.m.

Institution of Automobile Engineers: London Graduates.—Watergate House, Adelphi, W.C. 2. "Repairs," by Mr. C. A. Partridge. 7.25 p.m.